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RICHARD KOVACS, M.D.
New York, N. Y.

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Medical Department — U. S. Army — Medical Field Service School, Brooke Army Medical Center, San Antonio, Texas, and	James E. Tate, Lt. Col., M.C. Agnes P. Snyder	h	12[13]	Nov.	20	None	See Below
Fitzsimons General Hospital, Denver, Colorado or Walter Reed General Hospital, Army Medical Center, Washington, D. C.	Harold B. Luscombe, Col., M.C. Elsie Kuraner, Major, WMSC Emmett M. Smith, Colonel, M.C. Barbara Robertson, Capt., WMSC	Completion MFSS Completion MFSS	12[13] 12[13]	June June	10 10	None None	Certificate Certificate
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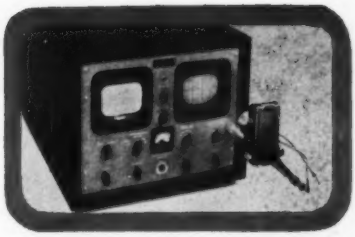

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FACIAL PARALYSIS *

Analysis of 500 Cases

HERBERT W. PARK, M.D.

Baruch Fellow in Physical Medicine, Harvard Medical School and Massachusetts General Hospital

and

ARTHUR L. WATKINS, M.D.

Associate in Medicine, Harvard Medical School; Chief of Physical Medicine, Massachusetts General Hospital

BOSTON

In 1821 Sir Charles Bell[1] accurately described the anatomic course of the seventh cranial nerve, and to support his thesis that this nerve was anatomically and functionally differentiated from the trigeminal nerve he presented a series of cases of facial paralysis. Some of these resulted from direct trauma and infection, but he mentioned idiopathic facial paralysis, stating, "It is very frequent for young people to have what is vulgarly called the blight; by which is meant, a palsy of the muscles of one side of the face and which the physicians know is not formidable." On reviewing the literature on idiopathic facial paralysis it can be readily seen that there is still no clearcut picture of the etiology, natural course of the disease or methods of treatment. It is, therefore, the purpose of this paper to present an analysis of 517 cases of facial paralysis of various etiologies seen at the Massachusetts General Hospital from 1932 to 1949, which will show something of the natural course of idiopathic facial paralysis and the effectiveness of conservative treatment. Also, it is hoped that this paper will stimulate further interest in the study of the disease.

Selection of Patients

Records were located on 206 patients who were observed and treated in the neurologic clinic of the Massachusetts General Hospital from 1932 to 1940. The remaining 313 were referred to the department of physical medicine of the Massachusetts General Hospital from 1940 to 1949 for examination and treatment. It is known that this is not the total number of cases seen at the hospital during this period. However, it is thought that this series represents a fair cross-section of the moderate to severe cases.

Analysis of Cases

Shown in table 1 is the distribution of cases according to the various

TABLE 1. — *Etiology of Facial Paralysis in 517 Cases*

Etiology	Number of Cases	Percentage
Idiopathic	451	87.2%
Trauma	31	6.0%
Infection	31	6.0%
Tumor	4	0.8%

* Read at the Twenty-Seventh Annual Session of the American Congress of Physical Medicine, Cincinnati, Sept. 8, 1949.

1. Bell, C.: On the Nerves: Giving an Account of Some Experiments on their Structure and Functions, Which Leads to a New Arrangement of the Systems, Phil. Trans., Roy. Soc. Lond. 3:398, 1821 (as quoted in Medical Classics 1:81 [Oct.] 1936.)

etiologies. It is apparent that idiopathic facial paralysis is by far the commonest type seen (451, or 87.2 per cent). Included in the idiopathic group are the cases of 42 patients who gave a history of exposure to drafts or cold. In only 1 instance was the exposure thought to be of certain significance. This case was one in which a night watchman had to uncover his right ear at frequent intervals on a very cold night to talk on a telephone, and on the following morning he noted the presence of a right facial paralysis. A reaction of degeneration did not develop, and normal facial function returned in five weeks. The remainder of the patients who gave a history of exposure included stories of "sitting in a draft," or "by an open window," or "driving the car with the window down," none of which were unusual in the daily routine.

Also included are 11 cases of questionable etiology, in 3 of which there was a history of syphilis and possible diagnosis of meningoencephalitis, in 3 questionable hypertensive encephalopathy, and in 5 others a possible infection of the middle ear or mastoid. These will not be considered in the analysis of idiopathic cases.

Further study of the idiopathic cases revealed them to be more frequent in women (249) than in men (191) with an approximate ratio of 9:7. Also, in both sexes paralysis was more prevalent on the right side (247) than on the left (193), with the same approximate ratio. Of 398 patients of idiopathic palsy with no history of exposure, the date of onset was known in 353. The largest number was seen in the months of February and June (38 cases each), and the least in November (22 cases). However, since the average number of cases seen each month was 29.41 and the standard deviation is ±6.56, no statistically significant seasonal variation occurred. Also, there was no statistical significance in the monthly variations observed in the cases with a history of exposure, these 42 cases being rather evenly distributed throughout the year, varying from 5 cases observed in February and August to 1 in July.

In chart 1 is shown the distribution according to age. The youngest

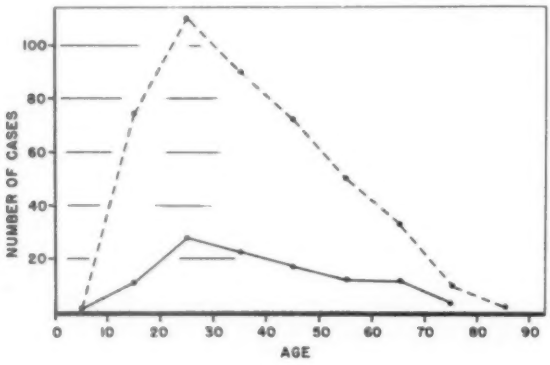

Chart 1. — Age Distribution: o — — — o, mild and severe disease; o———o, complete reaction of degeneration.

patient with idiopathic facial paralysis was 5 years old and the oldest 81. The largest number (110) were observed in the third decade age group. In this study, there was a marked increase in the number of cases with attainment of maximal body growth, and then the prevalence of the disease

gradually decreased with each succeeding decade. Also included in chart 1 are the cases of idiopathic facial paralysis in which a reaction of degeneration developed which will be commented on later.

Of 395 cases of idiopathic paralysis, it is known that in 87 per cent (343 cases) there was total loss of motor function on the involved side and in 13 per cent (52 cases) partial loss of function.

Electrical tests were done on 302 patients. Of these, 35 per cent had a partial reaction of degeneration and 52 per cent maintained a normal response. It is of interest that in no patient with idiopathic facial paralysis showing a normal response to electrical stimulation on or after the fourteenth day did a partial or complete reaction of degeneration subsequently develop.

The patients who had a complete reaction of degeneration are rather evenly divided as far as sex and side of involvement are concerned. Fifty-three were males and 54 females, and in both sexes the right side was involved 54 times and the left 53. The age distribution of the idiopathic cases that developed complete reaction of degeneration follows the same pattern as that of the total group, the greatest number (28) being in the third decade age group (chart 1).

Gustatory Function

Taste sensation on the anterior portion of the tongue was tested in 219 cases of idiopathic palsy, in 52 per cent of which there was impairment on the involved side. Of the 179 cases in which both electrical reactions and taste function were tested, there was taste impairment in 53 per cent. Of these, 52 per cent (49 cases) had a complete reaction of degeneration. However, only 33 per cent (85 cases) without taste impairment had a complete reaction of degeneration. This is essentially the same figure as found in the over-all statistics (35.2 per cent). It can be concluded, then, that complete reaction of degeneration is one and one-half times as frequent in the presence of taste loss.

Recurrence

Of the 440 patients with idiopathic facial paralysis, 31 (7 per cent) had recurrence. Twenty-four patients had a single recurrence; 6 patients had two recurrences, and 1 patient had three recurrences. In general, the recurrent attacks appeared to have a random distribution as to the side of involvement. A previous bout of facial paralysis did not predispose to a severe disease with the recurrence, as many of them were mild or transient.

Roentgenologic Studies

Roentgenologic studies of the ear and mastoid area was done on 28 patients. In 24 the studies were reported as negative. Included in this group were 9 patients with severe disease and 15 with mild disease as indicated by electrical tests. In 4 there was evidence of "sclerosis of the mastoid cells, but no evidence of active disease." In this group are included 2 with severe disease and 2 with mild disease as borne out by electrical tests.

Cerebrospinal Fluid Studies

Lumbar puncture was done on 24 patients with idiopathic facial paralysis (table 2). Of this group, 12 had a complete reaction of degeneration; 5 had a partial reaction of degeneration; 4 had no reaction of degeneration, and in 3 instances electrical tests were not done. Of the 12 patients who had a complete reaction of degeneration, the findings in 8 were reported to

be within normal limits. The remaining 4 had spinal fluid protein ranging from 42 to 60 mg. per hundred cubic centimeters, and in 2 there was pleocytosis. Of the 5 patients who had a partial reaction of degeneration, the findings in 2 were reported to be within normal limits, 3 had elevated spinal fluid protein and 1 case had pleocytosis. Of the 4 patients who had a normal response to electrical stimulation, 2 had elevated spinal fluid protein with no pleocytosis. One of the 3 patients who had no electrical tests had elevated

TABLE 2. — *Idiopathic Cases with Abnormal Cerebrospinal Findings*

Electrical Reaction	Time of Initial Return, Mo.	Total Duration, Mo.	Per Cent Recovery	Time of Lumbar Puncture, Weeks	Spinal Fluid Protein, Mg./100 Cc.	Spinal Fluid Cell Count
R. D.	4	8	60	3	60	0
R. D.	3	6	60	1 mo.	59	20 lymphocytes 3 monocytes
R. D.	3	5	80	1	42	3 polymorphonuclears 14 lymphocytes
R. D.	6	12	70	52	53	0
Partial R. D.	1	3	90	4/7	87	2 erythrocytes 47 lymphocytes 3 monocytes
Partial R. D.	3	6	80	1	69	0
Partial R. D.	½	1½	100	1	61	0
No R. D.	½	2	100	1	81	0
No R. D.	½	1	100	1	71	0
?	1½	?	?	1	62	0

spinal fluid protein without pleocytosis. Although cerebrospinal fluid studies were done in a relatively small group, the evidence appears to indicate that a significant number of these had abnormal spinal fluid findings, but there was no correlation between these findings and the severity of the disease.

Functional Results

In order to evaluate statistically the end results in the cases studied, the various residual stigmas of the disease were assigned numerical values. Loss of power in the obicularis oris muscle was rated 25 per cent, loss of power in the obicularis oculi muscle 25 per cent, contracture of the involved muscles 25 per cent, mass action of the facial muscles 15 per cent, spontaneous fasciculation of the facial muscles 5 per cent and tearing 5 per cent. These values were graded according to the degree of involvement observed. The percentage recovery in an individual case was determined by subtracting the numerical sum of the residual stigmas from 100 per cent. In the cases which were rated 100 per cent there was complete recovery; 80 to 100 per cent was rated good, 60 to 80 per cent fair and 10 to 60 per cent poor.

Of the 440 patients with idiopathic facial paralysis, 302 were followed throughout the significant part of the disease. Of these recovery was scored as complete in 66 per cent (199), good in 21 per cent (65), fair in 9 per cent (27) and poor in 3 per cent (8); 3 patients (1 per cent) had no functional return. The residual stigmas which were observed in 103 patients with partial

recovery are presented in table 3. Mass action of the involved facial mus-

TABLE 3. — *Residual Stigmas Seen in 103 Idiopathic Cases*

Residual	Mass Action, %	Weakness of Obicularis Oris, %	Weakness of Obicularis Oculi, %	Fasciculation, %	Tearing, %	Contracture, %
Mild	78	35	5	3	15	8
Severe	16	6	4	2	5	2
Total	94	41	9	5	20	10

cles was presented to a varying degree in 94 per cent of the patients. The other types of dysfunction in order of frequency were weakness of the obicularis oris muscle, tearing, contracture, weakness of the obicularis oculi muscle and spontaneous fasciculation.

Mass action of the involved facial muscles, which was the commonest defect observed, was demonstrated by several technics: (1) Careful observation of the face under adequate lighting revealed partial closure of the eye with smiling; (2) electrical stimulation of the facial muscles of one area caused synchronous contraction in other distant facial muscles, and (3) electromyographic studies revealed synchronous action potentials in the obicularis oris and oculi muscles with either smiling or closure of the eyelids (chart 3).

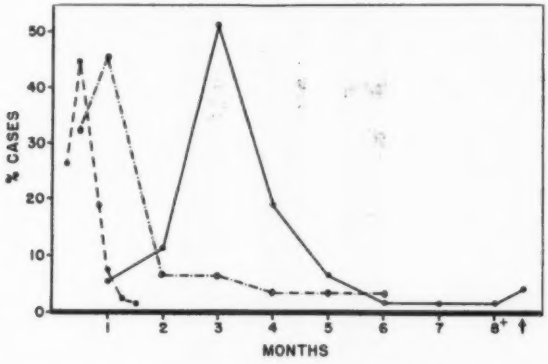

Chart 2. — Initial return of function as related to electrodiagnostic tests: o — — — o, 139 cases with normal reaction; o—·—·—·—o, 31 cases with partial reaction of degeneration; o————o, 80 cases with complete reaction of degeneration.

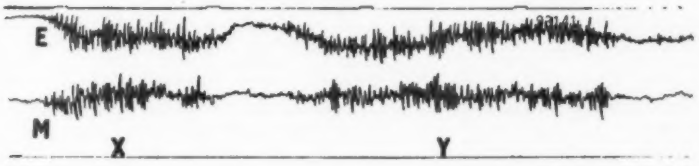

Chart 3. — Electromyographic evidence of mass action of facial muscles: simultaneous recording from the obicularis oculi muscle (*E*) and obicularis oris muscle (*M*) with closure of the eyelids (*X*) and smiling (*Y*).

Of the 302 patients who had adequate follow-up, 21 per cent had partial loss of function as maximum impairment and the remainder had complete paralysis. The initial return of function as related to electrodiagnostic tests is shown in chart 2. Of the 139 patients with normal response to electrical

tests, 45 per cent had initial return of function during the second week of the disease, and none waited longer than six weeks. In 31 patients with partial reaction of degeneration, 45 per cent had initial return of function during the fourth week of the disease, but 22 per cent were distributed over a period of several months with the last patient showing return of function in six months. Of the 80 with complete reaction of degeneration, 51 per cent had initial return of function during the third month, and the longest period observed before initial return occurred was eleven months. There is no correlation of the initial return of function with the age of the patient in the cases who had a complete reaction of degeneration. In general, this indicates that the duration of the paralytic phase of the disease can be estimated with reasonable accuracy from the results of the electrical tests at the end of ten to fourteen days.

The end result is related to the initial return of function. Of the 126 patients in whom initial return occurred prior to the third week of the disease, 95 per cent had complete recovery, with the remainder being scored as good. Of the 33 who had initial return during the fourth to sixth week, 58 per cent had complete recovery, 39 per cent were rated good and 1 was rated fair.

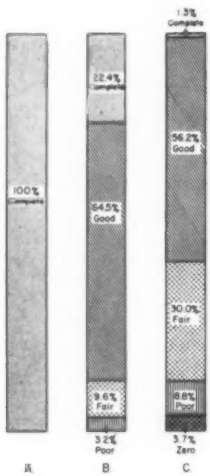

Chart 4. — End result as related to electrical tests: *A*, 139 cases with normal responses; *B*, 31 cases with partial reaction of degeneration; *C*, 80 cases with complete reaction of degeneration.

Of the 43 with initial return during the third month, none had complete recovery, 72 per cent rated good, 23 per cent rated fair and 5 per cent were poor. No patient who waited longer than six months for initial return of function had a satisfactory end result. In general, it can be concluded that an early return of function indicates a good prognosis for recovery.

As shown in chart 4, the end result is also related to the response to electrical tests. All patients with a normal response had complete recovery. Twenty-two per cent of the patients with a partial reaction of degeneration and 1 per cent with complete degeneration had complete recovery, and the remainder had chronic deformities of varying severity.

The rate at which maximal recovery ensued differed in the various groups. Those patients who had partial loss of function as maximal impairment had complete recovery within five days to one month, with the average being about two weeks. The patients who had complete paralysis and normal response to electrical stimulation had complete recovery varying from three weeks to four months after the onset, with the average being about two months. Of those who had partial reaction of degeneration, 7 had complete recovery within three months and 24 had maximal recovery from three to five months after the initial return of function. Of the patients who had complete reaction of degeneration, 1 had complete recovery in four months after onset of symptoms and the remaining 79 had maximal recovery four to six months after initial return of function. It is apparent that the electrodiagnostic test for reaction of degeneration is an adequate tool for predicting the course of the disease. However, this test does not indicate the degree of recovery that will be attained in patients with complete reaction of degeneration.

Treatment

In an attempt to evaluate the effectiveness of treatment, the 80 patients with idiopathic disease with complete reaction of degeneration were divided into two groups. The minimal requirements for the "treated" group of 57 cases consisted in luminous heat or hot packs to the involved side for twenty minutes twice a day, light stroking massage of the involved facial muscles twice a day, galvanic stimulation (or faradic stimulation when irritability returned) three times a week, passive exercises for the involved muscles until function returned (then active exercises) twice a day and care of the eyes twice a day. (Wire splints from the corner of the mouth to the ear were used in 17 patients, but it was discontinued because little or no benefit resulted.) The 23 "untreated" patients were taught facial exercises and care of the eye, both to be done twice daily, and they were followed at infrequent intervals.

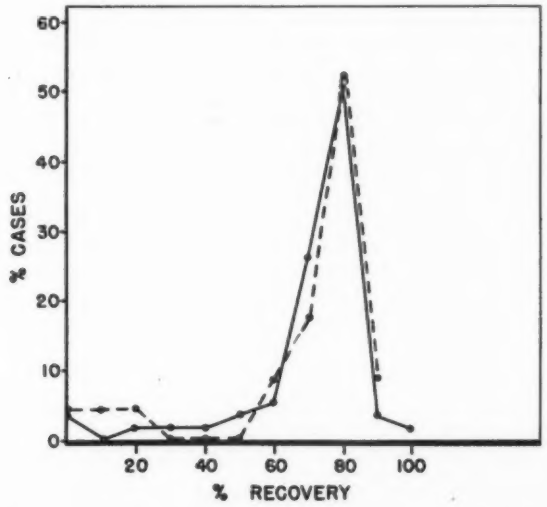

Chart 5. — End results as related to treatment: o———o, 57 "treated" cases; o — — — o 23 "untreated" cases.

The time at which initial return of function occurred was essentially the same for the two groups, being 3.4 months for the "treated" group and 3.1 months for the "untreated" group. Also, it is evident in chart 5 that the distribution of the "treated" and "untreated" cases is essentially the same as far as the end result is concerned. However, it is the clinical impression that the rate at which maximal recovery was attained is dependent to a certain extent on the degree to which the patient cooperated in doing facial exercises.

It is of further interest that in the patients with normal response to electrical stimulation and subsequent complete recovery, 79 had no treatment. Also, the end result was essentially the same in the 13 "treated" and 18 "untreated" patients with partial reaction of degeneration.

It can be concluded, then, that neither the rate of nerve regeneration nor the end result is altered by heat, massage or electrical stimulation. However, the time at which the end result is reached may be hastened by adequate physical therapy.

Comment

The disease "blight," or idiopathic facial paralysis, reported by Sir Charles Bell continues unabated and poorly understood. It is one of the commonest neurologic disorders seen, over 75 per cent of all cases of facial paralysis being in this classification. The few studies of large groups of patients with the disease confirm Bell's observation that it is seen most frequently in the young adult age group. Excepting these two considerations, there is no real agreement as to the nature of the disease.

Etiologic Factors. — The etiology (or etiologies) of the syndrome is not known. In general, the various theories which have been advanced include: (1) specific infectious neuritis; (2) vascular dysregulation with secondary ischemia of the facial nerve; (3) refrigeration; (4) subclinical mastoid infection involving the region of the fallopian canal, and (5) congenital stenosis of the fallopian canal associated with some precipitating factor.

Although there has been no investigative study of infectious neuritis as a cause of facial paralysis, Brock and Davidoff[2] expressed the opinion that this is the most probable cause. This opinion is based primarily on clinical observation of the course of the disease in comparison with other forms of specific infectious neuritis.

Kettel[3] has advanced the theory that the facial nerve impairment is a disease secondary to a local reflex vascular phenomenon. He has done early decompression of the facial nerve in 50 cases and has been able to demonstrate evidence of aseptic necrosis of the bony canal in 36 per cent and findings compatible with ischemia of the facial nerve in 56 per cent. Based on this evidence, he concluded that the cause is primarily "dysregulation of the circulation" of the fallopian canal and facial nerve. Recently, Hilger[4] concluded that facial paralysis is secondary to ischemic neuritis.

Exposure to cold or drafts has long been considered as the primary cause of facial paralysis. Cobb and Coggeshall[5] hypothesized:

> Edema of a nerve trunk may interrupt passage of the nerve impulses along axons, especially if the edema happens to be at a point at which the nerve is passing through a bony canal. A common case in point is that of the facial nerve which leaves the skull through the stylomastoid foramen. Exposure of the face to severe cold, a strong wind or local cooling (as in driving a closed automobile with only one window open so that

2. Brock, S., and Davidoff, L. M., in discussion on Merwarth, H.: Concept of Refrigeration as a Cause of Facial Paralysis, Arch. Neurol. & Psychiat. **61**:336 (March) 1949.
3. Kettel, K.: Bell's Palsy, Pathology and Surgery: A Report Concerning 50 Patients Who Were Operated on After the Method of Duel and Ballance, Arch. Otolaryng. **46**:427 (Oct.) 1947.
4. Hilger, J. A.: The Nature of Bell's Palsy, Laryngoscope **59**:228 (March) 1949.
5. Cobb, S., and Coggeshall, H. C.: Neuritis, J. A. M. A. **103**:1608 (Nov. 24) 1934.

the wind blows directly on the cheek) often brings on edema that blocks the foramen, presses on the facial nerve, and causes paralysis — so-called Bell's palsy.

In accord with this theory, Newman, Berris and Bohn[6] and Kovacs[7] have stated that over 75 per cent of all cases with spontaneous onset are due to refrigeration or exposure.

Sander[8] expressed the opinion that idiopathic facial paralysis may be caused by atypical, abortive or latent forms of ostitis in certain groups of the mastoid cells in the area of the fallopian canal. This opinion is based on findings in 2 cases in which decompression of the facial nerve was done. The findings are said to be consistent with this origin.

It has been pointed out by Leiner[9] that congenital narrowing of the fallopian canal is very common. His examination of 33 skulls revealed that 19 had a bony aperature of the stylomastoid foramen of 1/16 inch on the right and 1/8 inch on the left; 9 skulls had the converse, and in only 5 skulls were the foramens of equal and normal size. Because of these observations, he concluded that stenosis of the fallopian canal was the predisposing factor, and refrigeration was the precipitating cause of the paralysis. In accordance with Leiner's theory, Bergstrom[10] has reported a case of prolonged facial paralysis which was treated successfully by decompression. In this case, marked narrowing of the facial canal at the level of the horizontal semicircular canal was demonstrated at operation.

A study of this nature has little to contribute toward understanding the etiology of the disease. It does, however, offer certain clinical facts that are of interest. 1. It clearly demonstrates that the disease, mild or severe, has no seasonal prevalence. This fact was also observed by Waterman[11] in an analysis of 335 cases of idiopathic facial paralysis. Furthermore, the cases in this study in which exposure to cold or drafts was reported are distributed equally throughout the various seasons, and in only 1 case did refrigeration seem to be a probable etiological factor. 2. Although there appears to be a slight predominance of female patients and patients with right-sided involvement, combining the data with those of other large group studies reveals that there is no particular prevalence as to sex or side of involvement (tables

TABLE 4. — *Prevalence of Idiopathic Facial Paralysis According to Sex*

Author	Male	Female
Gower[12]	66	46
(1) Bernhardt[12]	34	23
(2) Bernhardt	32	23
Hübschman[12]	54	45
Sossinka[12]	128	172
Waterman[11]	191	144
Merwarth*	144	154
Park and Watkins	191	249
Total	840 (49.6%)	856 (50.4%)

* Merwarth, H. R.: Facial Paralysis—Prosoplegia, New York State J. Med. 44:1546 ((July 15) 1944.

6. Newman, M. K.; Berris, J. M., and Bohn, S. S.: Management of Facial Paralysis by Physical Measures, Arch. Phys. Therapy 21:270 (May) 1940.
7. Kovacs, R.: Evaluation of Physical Therapeutic Measures in Facial Paralysis, Arch. Phys. Therapy 22:145 (March) 1941.
8. Sander, P. G. H.: Two Cases of Facial Paralysis "a frigore" Cured by Decompression, J. Laryng. & Otol. 49:503 (Aug.) 1934.
9. Leiner, J. H.: Study of Etiological Factors Bearing on the Therapeutics of Bell's Facial Palsy, M. Rec. 95:319 (Feb. 22) 1919.
10. Bergström, E.: The Question of the Etiology and Treatment of What is Known as Rheumatic Facial Paralysis, Acta Oto-laryng. 34:541, 1946.
11. Waterman, G. A.: Facial Paralysis — A Study of 335 Cases, J. Nerv. & Ment. Dis. 36:65, 1909.

TABLE 5. — *Prevalence of Idiopathic Facial Paralysis According to Side of Involvement*

Author	Left Side	Right Side
Bernhardt[12]	49	63
Hobschman[12]	48	47
Waterman[11]	157	163
Park and Watkins	193	247
Total	447 (46.2%)	520 (53.8%)

4 and 5). 3. Of the 28 cases in which roentgenologic studies of the ear and mastoid area were done, only 4 revealed abnormal conditions, and this does not appear to be related to the severity of the disease. 4. It is of interest, however, that in 10 of the 24 cases in which lumbar puncture was done there were abnormal spinal fluid findings, giving evidence of a more diffuse disease of the central nervous system.

Natural Course of the Disease.—The natural course of the disease, idiopathic facial paralysis, is variable, but certain patterns may be identified. It has been estimated by Duel[13] and Pickerill and Pickerill,[14] that 70 to 80 per cent of all patients have spontaneous remission of symptoms. This is probably a reasonable estimate, since 66 per cent of the patients in this study had remission and since the patients observed were considered by the referring physician to have moderate to severe disease. In these cases the extent of the nerve lesion is insufficient to cause degenerative changes, and complete recovery is characteristic.

In general, the course of the disease in the patients who have degeneration of the facial nerve can be divided into three stages. The paralytic phase, which in about 70 per cent lasts for three to four months, is one of complete flaccid paralysis. Initial return of function signals the second stage of the disease. As function increases, in about two to four weeks a phase of hyperactivity ensues. This consists in marked mass action of the facial muscles and sometimes fasciculations, tearing and hyperacusis. This stage may last for two to six weeks and then slowly subsides over a period of three to five months, leaving the patient with chronic residual dysfunction and asymmetry characteristic of the end stage.

These residual abnormalities of varying degree are observed in nearly all cases with sufficient impairment of the facial nerve to cause degenerative changes. The degree of recovery is dependent primarily on the physiologic characteristics of nerve regeneration. As pointed out in Young's[15] review of this subject, (1) not all axons in the proximal end of the damaged nerve regenerate; (2) each regenerating axon subdivides into several fibers, and (3) the orientation of axonal fibers differs from the original pattern. This may account for all the residual stigmas that are observed in the disease. Mass action of the involved facial muscles and tearing are probably secondary to the misdirection of regenerating axon fibers, and weakness of the facial muscles may be proportional to the degree of nerve regeneration. Spontaneous fasciculation and contracture of the facial muscles may be dependent on all three factors together with an increase in motor impulses from a higher level.

Although the statistical analysis of the cases of facial paralysis with specific etiology has not been included, it is of interest that these cases had

12. Quoted by Waterman.[11]
13. Duel, A. B.: The Operative Treatment of Facial Paralysis, Brit. M. J. 2:1027 (Dec. 8) 1934.
14. Pickerill, H. P., and Pickerill, C. M.: Early Treatment of Bell's Palsy, Brit. M. J. 2:457 (Oct. 8) 1945.
15. Young, J. Z.: The Functional Repair of Nervous Tissue, Physiol. Rev. 22:318 (Oct.) 1942.

essentially the same clinical sequence of events depending on the degree of facial nerve impairment. Approximately 60 per cent of the patients had spontaneous remission of symptoms within two to five weeks, and the remainder had residual stigmas. About 50 per cent of the patients with a complete reaction of degeneration evidenced initial return of function during the third month, and 10 per cent of all the patients had no functional return.

Determination of the Prognosis. — In this study the most valuable tools for determining the prognosis in an individual case have been careful observation of the involved musculature and the standard electrodiagnostic test for reaction of degeneration. As evidenced in the analysis of cases, an early return of function or a normal response to faradic stimulation on the fourteenth day of paralysis indicates an excellent prognosis for complete recovery. A partial reaction of degeneration offers a variable prognosis. However, the prognosis for complete recovery in the cases with a complete reaction of degeneration is very poor.

Other electrodiagnostic methods which are useful in following the course of neurotization have been reported by Watkins.[16] Determination of the strength-duration curve offers objective evidence of progressive changes in the irritability of muscle as the nerve is regenerating, and electromyography offers objective evidence of early regeneration. Determination of the strength-duration curve was particularly useful in following cases when there was a question of whether the nerve was regenerating or whether maximal recovery had been attained. However, electromyography was not reliable in determining early regeneration because of stray pick-up from the adjacent muscles innervated by the trigeminal nerve.

Tumarkin[17] reported that pain in the area of the stylomastoid foramen and loss of taste associated with the onset of diopathic facial paralysis constituted a poor prognosis and that the facial nerve should be decompressed as early as possible. In this study there has been no attempt to classify the subjective symptoms. However, Waterman[11] found: "In 187 cases, showing a complete or partial reaction of degeneration of the affected nerve, 56 gave a history of pain at the onset, while of 96 patients who showed no change in faradic irritability of the nerve and recovered in from 2 to 6 weeks, 39 complained of aural or mastoid pain." This confirms the clinical impression in this study. Furthermore, it was observed in this study that 4 patients with partial loss of function, and 41 cases with normal electrical response and paralysis had taste impairment. Therefore, it is believed that loss of taste indicates the level to which the facial nerve is involved, and pain and loss of taste are not of reliable prognostic value in evaluating an individual case.

Evaluation of Treatment. — There are four general approaches advocated for treating idiopathic facial paralysis: 1. A significant number of surgeons believe that early decompression of the fallopian canal is indicated if a reaction of degeneration develop. 2. Several surgeons have expressed the opinion that decompression or nerve grafting should be done if the end result is not satisfactory or if there is no return of function by the sixth to the ninth month. 3. Many neurologists believe that only follow-up and reassurance is needed in the large number of cases. 4. Many physiatrists believe that if physical therapeutic measures are started early in the course of the disease a much greater number of patients will be cured.

16. Watkins, A. L.: Electrical Aids in Diagnosis and Prognosis of Nerve Injuries, Arch. Phys. Therapy 23:76 (Feb.) 1942.
17. Tumarkin, I. A.: Indications for Surgery in Severe Bell's Palsy, Brit. M. J. 1:580 (March 21) 1936.

Tumarkin,[17] Morris,[18] Juers[19] and Kettel[3] have each stated that early decompression of the fallopian canal in patients with idiopathic facial paralysis is indicated if reaction of degeneration or some other sign of poor prognosis develops. However, even when decompression is done as early as eight days after the onset of symptoms, as in a case reported by Kettel, it is difficult to understand why the additional trauma of surgery is warranted. The insult sustained by the facial nerve occurred eight days prior, and there is no guide to the exact prognosis in individual cases. If decompression were done within a few hours after the onset of facial weakness, it would be theoretically possible that in no case would a complete reaction of degeneration develop, but this would be a major operative procedure for many who have only a transitory facial weakness. It is also of interest that several of the patients reported on waited as long as six to nine months for the initial return of function.

Duel[13] and others[20] have advocated decompression of the fallopian canal or nerve grafting in cases of idiopathic facial paralysis with a poor end result and in cases with no return of function in six to nine months. Although many cases have been reported as having good results from the operative procedures, it is difficult to evaluate this form of treatment of the chronic deformities, since no statistical analysis of a series of cases is available. Nevertheless, on the basis of these reports operative procedures should be considered for those patients who have unsatisfactory end results.

In this study there is no objective evidence which indicates that the so-called "decongestive" measures of treatment, including heat, massage and electrical stimulation, alter the rate of nerve regeneration. The average length of time for initial return of function in the cases with partial and complete reaction of degeneration was essentially the same for both the "treated" and "untreated" patients. There is no objective evidence to show that electrical stimulation of the facial muscles in the paralytic phase three to five times a week altered the prognosis for recovery in the "treated" group. Also several patients with severe mass action were treated with daily electrical stimulation for several months without clinical improvement.

Splinting of the involved facial muscles has been suggested as a useful adjunct to other methods of treatment by Newman, Berris, and Bohn.[6] Pickerill and Pickerill[14] advised complete immobilization of the face with adhesive straps, stating that if the facial muscles are stretched recovery will not be complete. In this study there was an occasional need for splinting or suture of the eyelids. This was advised when return of function was delayed and excessive sagging of the face or epiphora developed. The clinical impression was that the stretching of the facial muscles which occurred during the paralytic phase was usually reversed in the hyperirritable stage of the disease.

In spite of the fact that "decongestive" measures have proved to be of little or no avail and splinting useful in only a few cases, it is the opinion that physical therapy has much to offer in the treatment of facial paralysis. By the use of electrodiagnostic methods in determining the prognosis and by demonstrating to the patient that his facial muscles are still capable of functioning, the physiatrist is able forcefully to combat untoward psychologic disturbances that are often observed as a result of the temporary disfigurement. It is also the clinical impression that the patients who cooperated in carrying out a program of facial exercises had the most rapid rate of re-

18. Morris, W. M.: Surgical Treatment of Bell's Palsy, Lancet 1:429 (Feb. 19) 1938.
19. Juers, A. L.: Facial Nerve Repair, Kentucky M. J. 40:453 (Nov.) 1942.
20. Bunnell, S. B.: Surgical Repair of the Facial Nerve, Arch. Otolaryng. 25:235 (March) 1937. Lathrop, F. D.: Treatment of Facial Paralysis, Lahey Clin. Bull. 3:59 (July) 1942. Tickle, T. G.: Surgery of the Facial Nerve in 500 Cases, Laryngoscope 55:191 (May) 1945.

covery following the initial return of function and the patients with severe mass action of the facial muscles could be taught better control by suppressing the emotional responses.

Although it appears that conservative treatment with physical therapeutic measures does not significantly alter the natural course of idiopathic facial paralysis, physical medicine has an important role in adequate care of patients with the disease.

Summary and Conclusions

Five hundred and seventeen cases of facial paralysis are reported, 87 per cent of which were idiopathic. In these cases only 1 patient gave a reliable history of exposure and 7 per cent had recurrnce.

Idiopathic palsy was most frequently observed in the young adults; however, there was no significant prevalence as to sex, side of involvement or season of year.

Cerebrospinal fluid was abnormal in 10 of 24 examinations. The results were not of prognostic value but suggested a possible infectious etiology.

Prognosis as to initial return of function can be determined by electrical testing, for (*a*) with normal responses, function usually returned in two weeks and never later than six; (*b*) with partial reaction of degeneration, the majority had return at one month, but occasional delay of two to six months was seen, and (*c*) three to four months elapsed before return in the presence of a reaction of degeneration.

The end result was also related to the electrical tests: (*a*) All patients with normal responses had complete recovery; (*b*) with partial reaction of degeneration, 87 per cent had good to normal results, and (*c*) with reaction of degeneration, some residual can be predicted, although the results were good in 57 per cent of cases.

Physical medicine is important in the care of these patients because (*a*) determination of the prognosis relieves anxiety; (*b*) when paralysis is prolonged, treatment may prevent emotional disturbances, and (*c*), although the course of the disease is not significantly altered by physical therapy, functional recovery appears to be hastened by muscle reeducation.

Discussion

Dr. William Schmidt (Philadelphia): I think that the authors of this paper deserve a great deal of credit for this very conclusive investigation of the subject of facial paralysis, and it has brought prominently to light several very important factors.

As to the cause of the disease, it seems to me that there must be something in the nature of infectious origin, as was shown in the changes that took place in the cerebral spinal fluid and also the fact that there is an actual degeneration taking place in the nerve.

The authors have mentioned the question of refrigeration and have not shown, except in 1 case, where it was definitely of importance. It seems to me, though, that there is more to this than has been shown by this paper, because it is noted — and I suppose others have had the same experience — that when 1 patient with facial paralysis comes into your department you always find half a dozen others coming in within a very few days. So it seems to me that some importance should be placed on the possibility of refrigeration as an exciting cause in the development of these cases of facial paralysis.

I think the important feature that this paper has brought out is the diagnostic and prognostic possibilities in physical medicine. It is definitely shown that you can form a definite prognosis as to the duration and the extent of the disease by the presence of the reaction of degeneration, and in those cases in which reaction of degeneration occurs there is going to be a long duration and the possibilities of some permanent residual deformity are very strong.

As far as the treatment is concerned, it seems from the results of this study that it doesn't make much difference whether you give the patient treatment or not. I think that there are definite reasons why these patients do need treatment.

In the first place, this is a rather disconcerting sort of disease, and patients are very much upset emotionally when they

find that they have a facial paralysis. They are very anxious to know, in the first place, how long it is going to last, and we can definitely give them some idea as to the length of time the condition is going to last and the possibilities of any permanent residual.

The treatment, I have always felt, should be conservative. Some of the older members will remember that in the days before the development of physical therapy the only treatment we had for facial paralysis was that prescribed in the textbooks on neurology, which was always that electricity may be tried; that still holds true with a great many neurologists, and they do prescribe the use of galvanic stimulation.

I feel that galvanic stimulation should not be used except for very definite reasons, because I undoubtedly have seen cases in which galvanic stimulation was used to excess from the beginning of these cases, and I think it has done harm. The only time that I use galvanic stimulation is in patients in whom I want to stimulate the morale, when I want to show them that there is some possibility of that muscle contracting; in those cases, if one can show the patients that the muscle will contract, it is a great encouragement to them and they will cooperate very much better.

Another important part of the treatment is to guide the patient into recovery, because when a patient has a paralyzed muscle there is always the tendency to overactivity of the stronger muscles, and if this is allowed to persist they will develop a hyperactive or a stronger muscle, which will produce a deformity in itself. It is necessary not only to exercise and reeducate the paralyzed muscles but also to restrain the activity of those muscles which have a tendency to be overactive.

In general, the treatment of facial paralysis requires a great deal of careful judgment in guiding the patient and securing his cooperation, reeducating and training the muscles and restraining the overdevelopment of those muscles which could in themselves produce some deformity.

I enjoyed this paper very much. I think every one should read the full contents of this paper when it is published, because it covers the story of facial paralysis very carefully and very thoroughly. It will give you a very clear idea of the whole subject and will be very much worth your while to take the time to read it completely.

Dr. K. G. Hansson (New York): I should like to ask Dr. Park two questions.

In facial paralysis, of course we deal with the facial nerve. The facial nerve innervates the muscles of the face and also the platysma of the neck. Did you notice the involvement of the platysma in your cases?

The second is, among the idiopathic cases, how many did you suspect of having poliomyelitis, if any? In this connection, what were the abnormal findings of the spinal fluid?

Dr. Park (closing): The records that we had to work with went back for many years, and clinical records are often very difficult to evaluate in setting the over-all picture of muscle control. I am sorry that I cannot give you an answer to the first question. We have no way of evaluating in the over-all study.

On your question pertaining to the cerebral spinal fluid examination, we accepted as abnormal cerebrospinal fluid findings elevation of the cerebral spinal fluid protein above the level of 50 mg. per hundred cubic centimeters, and cerebrospinal fluid cell counts above 5 cells.

We tried to drop out all cases in which there was a probable specific etiology. I think that there were 2 or 3 cases that were included in the questionable group that might have come into the classification of poliomyelitis.

THE SWEATING TEST IN NEUROLOGIC DIAGNOSIS *

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It is about 100 years since the initial observation was made that sweat glands are supplied with nerve fibers. Another quarter of a century passed before one experimentor stimulated the distal end of the several sciatic nerve of a cat and produced sweating of the paw. A year later it was shown that secretory fibers are contained within the sympathetic nerves. Twenty-two years ago Minor described the technic for the visualization of sweat patterns.[1]

We have found a modification of Minor's technic to be most satisfactory in determining the presence or absence of sweat in localized regions of the skin surface. Other substances which change color in the presence of sweating have been employed by various workers. These include quinizarin,[2] a ferric chloride-tannic acid mixture[3] and cobalt chloride.[4] These substances require that some method be used to induce sweating. Recently, a substance which induces sweating of itself has been employed as a locally acting diaphoretic. This substance (hexadinol) is recommended for supplanting pilocarpine and other general parasympathetic stimulants as a sudorific and as a diagnostic agent for the localization of anhydrotic areas in the skin.[5]

An entirely different approach for the determination of anhydrotic areas is that described by Richter who measured the changes in the electrical resistance of the skin.[6]

The technic which we employed is a modification of Minor's method. The patient is placed on a table which serves as the bottom part of a heating cabinet. The skin of the region to be investigated is painted with a solution containing tincture of iodine, castor oil and alcohol (iodine 215 cc. castor oil 250 cc. and alcohol 685 cc.). The castor oil serves to prevent "running" of the sweat during the test. The solution is painted on with a cotton swab or with a small brush. The distinctly yellow color of the solution permits of ready identification of any portion of the skin which has not been covered. Directly after the skin has been painted with this solution, it is dusted or sprayed with powdered cornstarch until the area presents a white appearance. The upper portion of the heating cabinet is then pulled down. The cabinet,

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* From the Departments of Neurosurgery and Physical Medicine, Mount Sinai Hospital.

1. Minor, V.: Eines neues Verfahren zu der klinischen Untersuchung der Schweissabsonderung; Deutsche Ztch. f. Nervenh. **101**:302, 1927.

2. (*a*) Guttmann, L.: The Management of the Quinizarin Sweat Test (Q. S. T.): Post-Grad. M. J. **23**:353 (Aug.) 1947. (*b*) Rose, D. L.: Colorimetric Demonstration of Sweat Pattern Changes in Peripheral Nerve Injuries; Arch. Phys. Ther. **25**:610 (Oct.) 1944. (*c*) Wilson, G. D.: Mapping Sensory Nerve; Arch. Phys. Med. **27**:78 (Feb.) 1946.

3. Silverman, J. J., and Powell, V. E.: Simple Technic for Outlining the Sweat Pattern; War Med. **7**:178 (March) 1945.

4. Roth, G. M.: Clinical Test for Sweating, Proc. Staff Meet., Mayo Clin. **10**:383, 1935.

5. Koppanyi, T.: Hexadienol, A Locally Acting Diaphoretic and A New Diagnostic Agent, J. Am. Pharma. Assoc. **34**:8 (Aug.) 1945.

6. Richter, C. P., and Woodroof, B. G.: Dermotomes in Man Determined by Electrical Skin Resistance Method; J. Neurophysiol. **8**:323 (Sept.) 1945. Richter, C. P.: Cutaneous Areas Denervated by Upper Thoracic and Stellate Ganglionectomies Determined by Electrical Resistance Method; J. Neurosurg. **4**:221 (May) 1947.

which is made of wood, is the one which we have employed for the induction of fever.[7] Its upper portion is counterweighted to permit easy motion. Within it are twelve 60 watt carbon filament lamps. The patient's entire body lies within the cabinet with only his head protruding. In order to encourage sweating of the face, the fans which are ordinarily used to cool this region are not turned on. Moistened towels are placed on racks within the cabinet to increase the humidity. We have found it best to apply heat to the entire body, even though our investigative interest is limited to one extremity, because of the interrelationships between various parts of the body during the process of heating.

The temperature within the cabinet is held to about 110 F. by varying the number of lamps which are turned on. The glass windows in the side of the cabinet allow frequent or continuous observation. This is important because the differences in temperature regulation of various patients is responsible for variations in the length of time before sweating begins and variations in the degree of sweating. It is important to observe the investigated area at brief intervals because frequently the margin between the sweating and the nonsweating skin can be seen clearly for but a short time. Then the involved area may become discolored gradually, with the result that after a while its appearance cannot be readily differentiated from that of the surrounding normally sweating skin. Guttmann has pointed out that areas bordering the lesion often sweat more actively and sooner than the rest of the body.[2a] We have not observed this phenomenon. Our tests were usually completed within one hour. A photograph of the involved area furnishes an excellent objective and permanent record of the neurologic lesion.

With this mixture which we employ the color changes are definite. The normal skin turns an intense blue-black color when sweating takes place. The involved areas remain an unchanged white or, if the sweating is slight, a whitish yellow. At the termination of the test the mixture is washed off with soap and water.

Thermoregulatory sweating is mediated by neural control, which begins apparently in the hypothalamic nuclei. The mammillotegmental bundle and the dorsal longitudinal fasciculus link the hypothalamic nuclei to the tegmental nuclei of the midbrain and to the reticular nuclei of the pons and medulla. This pathway is uncrossed. From these nuclei the fibers then are carried in the reticulospinal tracts, which after decussation (at pontile levels) travel down in the spinal cord at the innermost portion of the anterolateral tracts and synapse with the cells of the lateral column. Efferent fibers from the cells of the lateral column leave the cord via the ventral root, pass through the rami to the paravertebral sympathetic ganglion, thence back to join the spinal nerve and are distributed with the fibers of the motor nerves.[8]

Report of Cases

The following are cases illustrative of the value of the sweating test:

Case 1. — A young woman of 23 complained of aching pain radiating in the sciatic distribution. Motor, reflex and sensory changes were equivocal, and myelography revealed no abnormalities. A sweating test was done in an effort to see whether any evidence of root involvement could be demonstrated. There was hypohidrosis below the level of the tenth thoracic vertebra bilaterally. On prolongation of the heating period, the level was no longer apparent. In view of this fact, suggesting a level lesion of the cord, the patient was thoroughly revaluated but no confirmation was initially

7. Bierman, W.: Physical Medicine in General Practice, New York, Paul B. Hoeber, Inc., 1947.
8. Hyndman, O. R., and Wolkin, J.: Sweat Mechanism in Man; Study of Distribution of Sweat Fibers from the Sympathetic Ganglia, Spinal Roots, Spinal Cord and Common Carotid Artery; Arch. Neurol. & Psychiol. 45:446 (March) 1941. List, C. F., and Peet, M. M.: Sweat Secretion in Man, ibid. 42:1098 (Dec.) 1939.

found. However, within the following year, much of the classical picture of multiple sclerosis developed. One of the manifestations was a very definite level lesion of the cord at the tenth thoracic segment. In this patient, an abnormality on the sweating test was the first objective evidence of a disease process which did not become further apparent for some time.

CASE 2. — A patient of 63 had a six month history of increasingly severe pain in the fifth lumbar nerve root segment on the left, with mild sensory loss in this segment. Myelography demonstrated a round defect in the cauda equina, about 0.5 cm. in diameter. At laminectomy (by Dr. Sidney Gross) a neurofibroma of the fifth lumbar nerve root was found intradurally and was resected with the involved nerve root. Postoperatively, it was desired to map the area of denervation. The sweating test clearly showed the dermatome of anhidrosis and demonstrated the exactitude with which such dermatomes may be delineated and recorded.

CASE 3. — In a man of 55, a Brown-Sequard syndrome occurred on the right, the result of a neoplasm of the cord at the level of the third and fourth cervical vertebrae. There was a Horner syndrome on the right. Sweating on the ipsilateral side of the face and body was completely absent.

Summary

Impairment of the sympathetic nerve supply to a region can be detected by the anhidrosis or hypohidrosis which occurs in contrast to the normal sweating of the skin. These changes in the activity of the sweat glands can be utilized for the diagnosis and for the determination of the extent of peripheral nerve injuries, for localization of levels of cord injury and for a check on the results of a sympathectomy.

The sweating test is best performed in the department of physical medicine because the necessary apparatus and personnel exist there. We have found the test to be a reliable, informative one which can be readily performed if the necessary apparatus and personnel be available. It should be more widely used in the diagnosis of neurologic lesions, in addition to other diagnostic measures which physical medicine can offer to the neurologist, such as electromyography and electrical testing of muscles and nerves.

The discussion of this paper will appear in a later issue of the ARCHIVES.

IMPORTANT NOTICE

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ELECTROPHORESIS OF THE WATER-SOLUBLE PROTEINS OF NORMAL AND ATROPHIED MUSCLES NON-TREATED AND TREATED BY DAILY ELECTRICAL STIMULATION *

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RICHMOND, VA.

In previous studies in this laboratory[1] on the aldolase activity of normal and denervated muscle it was concluded not only that with atrophy the myogen content of the muscle diminishes but that also the specific enzymatic activity of the myogen decreases considerably. There were indications that the so-called myogen solutions studied after separation from salt-soluble proteins by twenty-four hours dialysis against distilled water contained, in addition to myogen, other proteins in proportions varying with progressive denervation atrophy. If the amount of nonmyogen but water-soluble proteins increases considerably in the later stages of denervation atrophy, this conclusion might be invalidated. Therefore, fractional analyses of such myogen solutions were performed with the Tiselius electrophoretic apparatus.

Method

The gastrocnemius-soleus muscles of rabbits were investigated after suitable periods of atrophy, the contralateral muscles serving as controls in all experiments. In those treated by electrical stimulation the untreated atrophied contralateral limb served as control.

From a freshly killed rabbit the gastrocnemius-soleus muscles were excised and chilled for fifteen minutes in ice water. The chilling, adopted from the method of J. J. C. Jacob,[2] minimized an unidentified turbidity which interfered with the photography of the electrophoretic pattern. The chilled muscle was minced to a pulp, mixed with glass-distilled water (3 parts of water to 1 of pulp) and extracted while mechanically stirred for thirty minutes at room temperature. The mixture was centrifuged and the resultant decanture dialyzed in collodion tubes for two hours against a large amount of distilled water (room temperature). This dialysis served to remove the remaining electrolytes and to precipitate as nearly as possible all material insoluble in water. Any volume change in extract during dialysis was recorded and the final results corrected accordingly. The extract was then dialyzed against 0.011 molar phosphate buffer at pH 7.5 for twenty hours (two hours at room temperature and eighteen hours in a cold room at 8 C.).

The refractive index gradients for the various protein fractions were then determined by electrophoresis[3] for two and one-half hours at 7 volts per cubic centimeter in a

* From the Department of Physiology, Medical College of Virginia. This project of the Baruch Center of Physical Medicine was performed partly under contract between the Office of Naval Research and the Medical College of Virginia.
* Read at the Twenty-Seventh Annual Session of the American Congress of Physical Medicine, Cincinnati, Sept. 10, 1949.

1. (a) Fischer, E.: Some Enzyme Systems of Denervated Muscle, Arch. Phys. Med. **29**:291, 1948. (b) Fischer, E., and Bowers, R. V.: Changes in Zymohexase Activity During Denervation Atrophy of Skeletal Muscle and Their Retardation by Appropriate Electrical Treatment, Federation Proc. **7**:54, 1948.
2. Jacob, J. J. C.: The Electrophoretic Analysis of Protein Extracts from Striated Rabbit Muscle, Biochem. J. **41**:83, 1947.
3. Longsworth, L. G.: Optical Methods in Electrophoresis, Indust. & Eng. Chem. **18**:219, 1946. Longsworth, L. G.: The Quantitative Interpretation of the Electrophoretic Patterns of Proteins, J. Phys. & Colloid Chem. **51**:171, 1947.

11 ml. Klett Tiselius cell at 2 C. In a few experiments, after electrophoresis samples of the extract were removed from the various protein layers and analyzed for aldolase activity. In all experiments samples of the extracts submitted to electrophoresis were tested for their aldolase activity.[4]

Results

Normal Muscle. — Figure 1 shows a typical descending and ascending electrophoretic pattern of such a myogen solution from a normal rabbit gastrocnemius. Five fractions, numbered according to increasing migration velocity, are easily discriminated. The descending and ascending patterns are much more similar than in electrophoresis of serum proteins. Since, as a rule, the descending pattern is somewhat better suited for analysis, all further

Fig. 1. — Descending (left) and ascending (right) electrophoretic patterns of myogen solution from normal rabbit muscle.

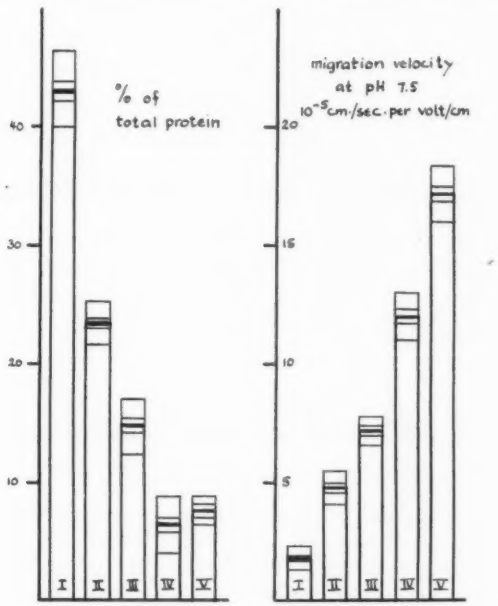

Fig. 2. — The means, standard deviations and standard errors for the size of the five fractions and for their migration velocities in 20 normal muscles.

references pertain only to the descending pattern. Statistical analyses of the patterns of 20 normal muscles from different rabbits revealed a constant behavior, as demonstrated by figure 2, which gives the means, standard de-

4. Herbert, D.; Gordon, H.; Subrahmanyan, V., and Green, D. E.: Zymohexase, Biochem. J. 34:1108, 1940.

viations and standard errors for the percentage of total protein present, as represented by each of the five fractions, and for their migration velocities.

After electrophoresis only fraction I contained any aldolase activity. However, the total activity contained in this fraction was distinctly less than the total activity of the nonelectrophorized extract. This can be explained by the observation of Taylor, Green and Cori[5] that electrophoresis of a solution of crystallized myogen loses activity during electrophoresis, probably due to some precipitation of the aldolase. The migration velocity found for fraction I checks well with those reported by others[6] for true myogen, especially if the differences in *p*H and ionic strength are considered.

The migration velocity of fraction V corresponds well with that of myoalbumin as described first by Bate-Smith[7] and confirmed by others.[8]

The behavior of fractions II and III correspond fairly well to the myosin β and myosin α of Jacob[9] and of Dubuisson.[10] This identification is supported by observation in this study that the main difference between the electrophoretic patterns of the crude extract and of the water-dialyzed extract is the diminution of fractions II and III.

Fraction IV remains unidentified. Jacob[2] and Dubuisson[6b] observed a similar fraction, which they labeled as the slowest subfraction of myoalbumin.

Denervation Atrophy. — In denervation atrophy of a few days' duration the changes in the electrophoretic pattern are relatively small, as shown in figure 3, in which a muscle denervated for five days (left) is compared with

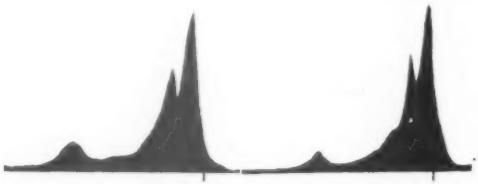

Fig. 3. — Electrophoretic patterns of a muscle denervated five days (left) and of its normal control muscle (right).

its normal control muscle (right). However, after a longer period of denervation the differences become more distinct, as demonstrated in a muscle denervated for twenty-five days (fig. 4).

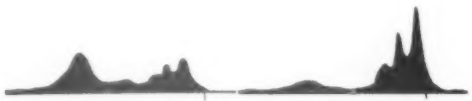

Fig. 4. — Electrophoretic patterns of a muscle denervated twenty-five days (left) and of its normal control muscle (right).

To evaluate quantitatively these changes in electrophoretic pattern, the increase or decrease in each fraction was calculated and expressed in per cent of the absolute protein value of that fraction in the normal control muscle. Figure 5 gives the mean values found in this way for groups of 4 to 6

5. Taylor, J. F.; Green, A. A., and Cori, G. T.: Crystalline Aldolase, J. Biol. Chem. **173**:591, 1948.
6. (*a*) Disteche, A.: Étude des conditions de précipitation et de crystallization de protéines musculaires du groupe myogène, Biochem. et biophysica Acta **2**:265, 1948. (*b*) Dubuisson, M.: Étude électrophorétique des protéines musculaires, Bull. Acad. roy. de Belg. (series V), **23**:769, 1947. (*c*) Taylor, Green and Cori.[5]
7. Bate-Smith, E. C.: Native and Denatured Muscle Proteins, Proc. Roy. Soc., London, S. B. **124**:136, 1937; Cataphoretic Behaviour of Zymohexase, Biochem. J. **34**:1122, 1940.
8. Taylor, Green and Cori.[5] Dubuisson.[6b]
9. Jacob, J.: Étude électrophorétique des variations de composition d'extraits musculaires de lapin sous l'influence de la fatigue et la contracture par le monobromacétate de soude, Experientia **3**:241, 1947. Jacob.[2]
10. Dubuisson, M.: Séparation, par voie chimique, des myosines α et β. Experientia **2**:412, 1946. Footnote 6b.

animals with one gastrocnemius denervated for comparable periods. Fraction I, myogen, declines distinctly only after a delay of several days, and is about halved in three weeks. Fraction II, myosin β, declines at a slower rate than

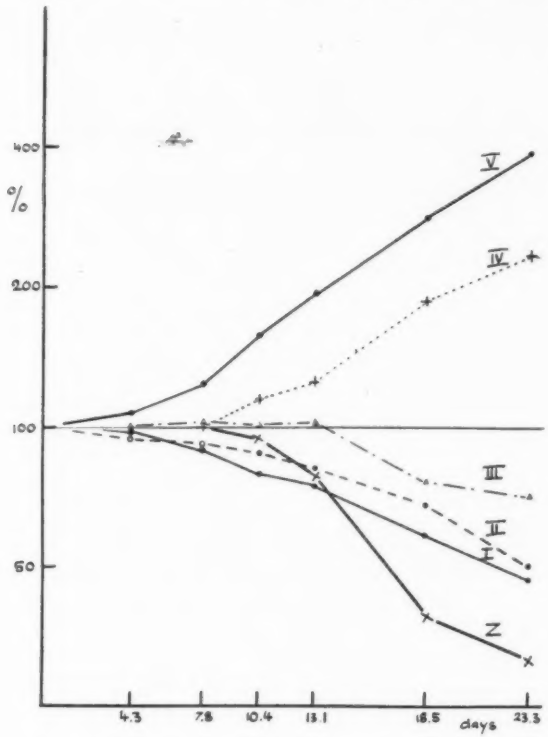

Fig. 5. — Mean values of five protein fractions and of aldolase activity in groups of animals denervated for comparable periods, expressed in percentage of the normal control muscle values.

myogen; fraction III, myosin α, diminishes less and the delay in its onset is much longer. Fraction V, myoalbumin, increases rapidly almost from the start, and the unidentified fraction IV increases considerably after some delay.

Recently Crepax[11] published results obtained with a similar but not identical method, according to which these changes progress at least up to eighty-four days of denervation. Because he apparently pooled muscles to obtain sufficient material and failed to give the pattern of corresponding normal muscle, exact quantitative evaluation is impossible.

Determinations of the aldolase activity of the solutions corroborated previous findings[18] that the enzymatic activity decreases only after a considerable delay but declines finally much more than the content of water-soluble protein. These new experiments demonstrate that the enzymatic activity also declines more than the true myogen fraction (fig. 5). Therefore, our previous conclusion, that during denervation atrophy not only myogen but also its specific activity declines, can be maintained. However, the decrease in ac-

11. Crepax, P.: Influence de l'énervation sur la composition des estraits protidiques des muscle striés, Experientia 5:167, 1949.

tivity is less than assumed previously when the relative and absolute increase of nonmyogen proteins were not considered.

Denervation Atrophy Treated Daily by Electrical Stimulation. — In a limited number of experiments the two gastrocnemius muscles were denervated simultaneously and then one treated three times daily with appropriate electrical stimulation.[12] In the treated muscle a considerable delay occurred in

Fig. 6. — Electrophoretic patterns of a denervated muscle treated by daily electrical stimulation (left) and of its denervated untreated control muscle.

the decline of aldolase activity and a rather pronounced delay in most of the electrophoretic changes (fig. 6). In no case was a normal pattern restored, but fraction V, myoalbumin, was always much less in the stimulated muscle than in the untreated control (averaging 66 per cent of the control). Fraction I, myogen, and fraction III, myosin α, increased 6 per cent above that in the control muscle; fraction II, myosin β, remained unaltered. The unidentified fraction IV averaged 32 per cent greater than in the control.

In evaluating the changes in protein fractions extracted from muscle, due consideration must be given the question of whether these changes are really caused by corresponding alteration of the muscle protein or are due only to altered extractability of the fractions. The influence of altered extractability is deemed of little importance in the changes occurring during denervation. This is demonstrated by the fact that the decreases in total protein found in this study with the electrophoretic method correspond rather well with the decrease in total noncollagenous protein as determined by chemical methods.[13] In our studies only electrical stimulation and fatigue had any distinct influence upon extractability. Both decrease extractability.[14] In a comparison of denervated muscle with the normal control, any fatigue of the normal muscle would only increase the observed diminution of myosin in α and β found by the electrophoretic method. However, in the treated denervated muscle, stimulation and fatigue may affect the results despite the fact that the animals were killed at least twenty-four hours after the last treatment by electrical stimulation. This effect on extractability might explain why, despite the marked decrease in myoalbumin, myosin β is not increased at all and myosin α increased only 6 per cent according to the electrophoretic pattern.

The increase in myoalbumin during denervation suggests the hypothesis that the specific muscle protein, like myogen and myosin, deteriorates and forms myoalbumin. Such a hypothesis could also explain the increase in unidentified fraction IV, which could be due to deteriorated specific proteins which have not yet reached the small size and high mobility of myoalbumin. The fact that, in a comparison of stimulated with untreated denervated muscle, fraction V decreases while fraction IV increases would support this hypothesis. Myoalbumin being built up to specific protein would go through the reverse process, through stages of increased size and decreased mobility approaching that required by true myogen and myosin.

12. Fischer, E., and Ramsey, V. W.: The Effect of Daily Electrical Stimulation of Normal and Denervated Muscles Upon Their Protein Content and Upon Some of the Physicochemical Properties of the Protein, Am. J. Physiol. **145**:583, 1946.

13. Fischer, E., and Ramsey, V. W.: Changes in Protein Content and in Some Physicochemical Properties of the Protein During Muscular Atrophies of Various Types, Am. J. Physiol. **145**:571, 1946.

14. Dubuisson, M.: Differenciation électrophorétique de myosines dans les muscles au repos et fatigués, de mammifères et de mollusques, Experientia **2**:258, 1946. Mrazek, R. G., and Reid, C. I. The Effect of Muscular Fatigue on the Solubility of Myosin, Am. J. Physiol. **149**:177, 1947. Footnote 1.

Atrophy Due to Tenotomy. — While in denervation atrophy the changes in electrophoretic pattern typically occur after a rather pronounced delay, the similar changes found in atrophy due to tenotomy begin much earlier. This is demonstrated by figure 7, which compares a muscle six days after tenotomy with the normal control muscle. Aldolase activity, which does not decline in denervation atrophy before the tenth day, is decreased distinctly a few

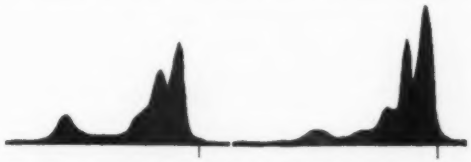

Fig. 7. — Electrophoretic patterns of a muscle six days after tenotomy (left) and of its normal control muscle.

days after tenotomy. It is well known that a tenotomied muscle shortens and undergoes contracture, apparently due to the arriving tonic nerve impulses. The question arises, therefore, whether simultaneous denervation, which prevents tenotomy contracture, would also prevent the early changes in electrophoretic pattern. Figure 8 shows the pattern of a muscle ten days after denervation and tenotomy compared with that of a control muscle only

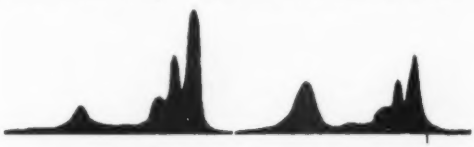

Fig. 8. — Electrophoretic patterns of a muscle ten days after denervation and tenotomy (left) and of its tenotomied control muscle.

tenotomied. From this and similar experiments it is obvious that denervation, done at the time of tenotomy, prevents the early changes in electrophoretic pattern and the early decline in aldolase activity which are typical for the muscle only tenotomied. Figure 9 shows photographs of a muscle pair used in one of these experiments. The two muscles have, incidentally, exactly the same weight, indicating equal weight loss in the seven days following operation. It is evident that the left muscle, tenotomied only, is in contracture, while the right muscle, tenotomied and denervated, has normal length. It should be pointed out here that, as a rule, the tenotomied muscles atrophied a little more quickly than the tenotomied and denervated muscles (figure 10).

After about eighteen days, no protective influence of denervation upon the changes following tenotomy can be observed. The probable reason is that denervated muscles begin to undergo their main changes at the end of the second week, when tenotomied muscles reach their maximal changes. A partial repair of the tendon gap by connective tissue occurs, and the resultant shrinkage of the newly formed connective tissue bridge diminishes the contracture and may even restore limited muscular function.

In all experiments of shorter duration than 15 days, this protective action of denervation was found. The extent of this protection is illustrated by figure 10, which gives mean values for groups of operated animals. The electrophoretic pattern and aldolase activity of muscles with a mean denervation time of 7.8 days show a moderate increase in myoalbumin as the only

significant change. The group of muscles tenotomied for the same period shows approximately 20 per cent decrease in myogen, in both myosins and in aldolase activity, but myoalbumin is more than doubled. In many respects these changes are equal to those observed in muscles after 12.5 days' denervation. The changes in the group of muscles tenotomied and denervated for 7.8 days are almost as small as those in muscles denervated only for the same length of time.

These experiments demonstrate very well the deteriorating influence of maintained weak contraction upon skeletal muscle. In many arthritic patients atrophy is beyond that which could be explained by the diminished use of the limb. Raymond[15] in 1890 published evidence that in experimentally

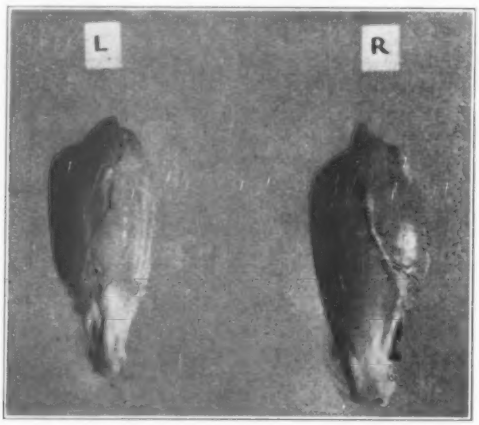

Fig. 9. — Muscles of equal weight excised from the same rabbit seven days postoperatively, the left only tenotomied and the right tenotomied and denervated.

induced arthritis weak muscular contraction can be maintained by reflex mechanism and that section of the dorsal roots diminishes the progress of

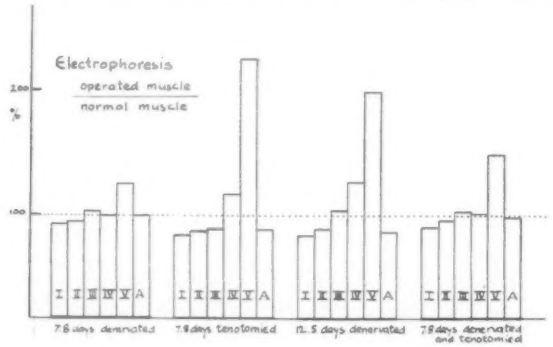

Fig. 10. — Mean values of the five protein fractions and of aldolase activity in four groups of atrophied muscle, expressed in percentage of the normal control muscle values.

15. Raymond, F.: Recherches expérimentales sur la pathologénie des atrophies musculaires consécutive aux arthritis traumatiques, Rev. de méd., Paris **10**:374, 1890.

atrophy in the arthritic limb. However, only recently have clinicians[16] realized that in human rheumatoid arthritis the atrophying muscles, or at least parts of them, are not in complete rest but rather are in a state of mild tonic contracture which enhances atrophy.

In a small series of experiments a tenotomied and denervated muscle was compared with a control muscle which was only denervated. The results varied, sometimes the denervated muscle — being deteriorated less than the doubly operated muscle, while in other experiments the reverse was true. The mean pattern calculated for these two conditions showed no difference of statistical significance. The high experimental variation may be connected with the large difference in degree of tendon repair observed.

Comment

This investigation has shown that the electrophoretic pattern of the water-soluble protein in skeltal muscle is rather consistent, provided a standard technic is used. It should be pointed out that conditions (pH, ionic strength, duration of electrophoresis) were deliberately chosen to obtain a relatively simple pattern.[17] In preliminary experiments subdivisions of all five peaks were produced by changing these conditions. However, even the pattern for normal muscle varied greatly from experiment to experiment and made detection of small changes produced by denervation of short duration impossible. It is well known that electrophoresis under certain conditions separates proteins which cannot be distinguished by chemical methods.[18] Bailey[19] pointed out that such subdivisions of electrophoretic components might be due only to differences in the net electric charges of the complex protein molecules.

Summary

Water-soluble proteins extracted from rabbit muscles were analyzed by electrophoresis in the Tiselius apparatus and were tested chemically for aldolase activity. The five protein fractions present were: I, myogen, containing the only aldolase activity; II, myosin β; III, myosin α; IV, unidentified, and V, myoalbumin. Descending electrophoretic patterns were analyzed statistically.

Normal muscles from different rabbits showed a consistent behavior. Denervated muscles revealed changes progressing with duration of denervation atrophy, fraction V increasing, all other fractions decreasing and aldolase activity decreasing. These changes were delayed but not prevented by treating the denervated muscle with daily electrical stimulation.

In muscles atrophied by tenotomy, changes in protein fractions were similar to those occurring in denervation atrophy but occurred earlier in the postoperative period. The decline in aldolase activity also occurred sooner. Denervation, performed simultaneously with tenotomy, prevented the shortening of the muscle, the early changes in electrophoretic pattern and the early decline in aldolase activity, all of which were typical for the muscle only tenotomied. These experiments demonstrate the deteriorating influence upon skeletal muscle of maintained weak contraction such as can occur in rheumatoid arthritis.

16. Bayer, H.: Die rheumatische muskelhärte — Ein Reflextetanus, Klin. Wchnschr. **27**:122, 1949. Mead, S., and Clare, M. H.: An Electromyographic Study of Rheumatoid Arthritis, Seventh International Congress on Rheumatic Diseases, New York, 1949, p. 59. Morrison, L. R.; Short, C. L.; Ludwig, A. D., and Schorab, R. S.: The Neuromuscular System in Rheumatoid Arthritis. Electromyographic and Histologic Observations, Am. J. M. Sc. **214**:33, 1947. Schlesinger, E. B., and Ragan, C.: "Muscle Spasm" in Acute Low Back Pain and Similar Syndromes, Am. J. Med. **1**:621, 1946. Trommer, P. R., and Cohen, A.: The Use of Neostigmine in the Treatment of Muscle Spasm in Rheumatoid Arthritis and Associated Conditions: Preliminary Report, J. A. M. A. **124**:1237, 1944.

17. Jacob,[5] Dubuisson.[6b]

18. Perlman, G. E.: Electrophoretic Behaviour of Mortified Ovalbumins, Nature **161**:720, 1948.

19. Bailey, K.: Structural Protein of Muscle: Annual Reports on the Progress of Chemistry, London, The Chemical Society, 1947, p. 280.

PHYSICAL MEDICINE AND PERIPHERAL VASCULAR DISEASE *

FAY LE FEVRE, M.D.

CLEVELAND

The importance of physical medicine in the treatment of peripheral vascular disease has long been recognized. In the past, many measures so classified have been employed. Some of these have thus far proved of value, while others have been discarded. It is not my purpose to summarize the value of all methods, past and present, but to discuss those that my colleagues and I have found to be of help and are using at the present time. It is still extremely important to remember that success in vascular care cannot be obtained without the avoidance of tobacco, trauma and exposure to cold.

I should like to stress that the successful treatment and management of any case of peripheral vascular disease depends on complete cooperation among the internist, the surgeon and the physician responsible for the physical medical measures, as well as the dermatologist. The following brief case report illustrates the importance of medical and surgical consultation and cooperation.

Report of a Case

A man, aged 55, was first observed in March, 1949. His general health had been excellent, but six months prior to examination he had first noticed fatigue of the leg and foot. True claudication developed, and shortly before his admission to the Clinic he was unable to walk more than one city block before experiencing cramps in the leg. One week before admission he injured his left first toe while at work, and constant pain developed.

Examination indicated definite evidence of reduced arterial circulation of both limbs. An area of ulceration and discoloration involved the left first toe, and there was cellulitis over the dorsum of the foot. Roentgen examination of the extremity did not show bony changes or arterial calcification. The routine urine sugar estimation was 4 plus and the fasting blood sugar 380 mgm. per cent. The serum cholesterol determination was 300 mgm. per cent.

Diagnosis

The patient was hospitalized at once and advised to discontinue smoking. Diabetic control was started, and an oscillating type bed was used. In addition, penicillin in the amount of 50,000 units was given every 3 hours and local foot care was instituted. Controlled heat between 90° and 93° F. was applied with comfortable results. Caudal blocks were started for relief of pain as well as for temperature studies. Ten days after hospitalization, a sharp line of demarcation had formed at the base of the first left toe. No infection was obvious and the foot was comfortable. Because of good temperature responses following caudal block, a lumbar sympathectomy was performed twelve days after hospitalization. On the twentieth hospital day the left first toe was amputated and the patient was discharged eight days later. Strict diabetic care was outlined and Buerger-Allen exercises and general vascular directions prescribed. Healing was complete six weeks after admission to the hospital.

Comment

This case report illustrates the importance of using various methods of treatment. One cannot determine ahead of time the exact program of treatment for any type of vascular disease or complication. In 1940 Wright[1] stated: "It is important that the recent trend in certain quarters toward sub-

* From the Cleveland Clinic and the Frank E. Bunts Educational Institute.

1. Wright, I.: Conservative Treatment of Occlusive Arterial Disease, Arch. Surg. 40:163 (Feb.) 1940.

mitting all patients with vascular disease to the same form of therapy, whether it be use of the pressure suction boot, administration of hypertonic saline solution or intravenous administration of typhoid vaccine be discouraged. The problems presented by different diseases and by different patients with the same disease are more frequently unlike than identical." This advice remains sound.

The following physical medical measures have been found by us to be helpful and are used regularly when indicated in peripheral vascular disorders.

Heat. — The use of heat as a physical medical agent is time honored as the basic form of treatment in peripheral vascular diseases of both an arterial and a venous nature. Excessive heat, as is known, increases the metabolic demands for greater blood flow and rapidly depletes the available tissue nourishment. In the presence of arterial insufficiency, the increased demand caused by the excessive heat cannot be supplied. The ischemia and the tendency toward gangrene are therefore increased. When direct heat is applied locally to a limb with decreased arterial circulation, no type of high temperature heating apparatus should be used. These include short wave diathermy, electric bulbs, infrared rays, hot water bottles and hot foot soaks of various medicated or nonmedicated solutions.

In arterial disease heat, however, can be applied safely. When applied directly it should be always controlled thermostatically with use of one of the accepted thermostat cradles. The ideal temperature usually ranges between 88 and 95 F., and should not exceed the latter figure.

All workers in this field have observed that certain patients cannot tolerate heat. This may indicate that the heat level tried is too high, or above 95 F. It may also indicate extensive organic occlusion with pronounced limitation of circulation. Patients in this group may be more comfortable with cold applications. Gangrene is frequently a sequence in this type of case.

We have found it helpful to explore the degree of vasodilation by means of a caudal or lumbar parasympathetic nerve block before attempting to use heat. If a reasonable rise of temperature occurs after procaine block (such as 3 to 6 degrees F.), it is then safe to use direct controlled heat by the method previously mentioned. If there is no response, heat applied directly may be injurious.

When direct local heat cannot be used, it is always possible to use heat reflexly. A simple method is to apply a heating pad to the lumbar region or abdomen. Patients under treatment at home should always be advised to use heat in this fashion. Short wave diathermy may also be used in a like manner. In my opinion, short wave diathermy should not be applied locally to the extremities in the presence of organic vascular disease. The Sitz bath is another form of reflex application which can be used with benefit, especially by the patient who is ambulatory, and in whose therapy heat is found to play an important part. I have discontinued the use of contrast baths because of the belief that the alternate application of hot water and cold water is harmful.

In this discussion I must include the electric blanket. I have a number of patients who suffer from night cramps in the legs. Some have demonstrable vascular disease, and some do not. Both groups have obtained relief by using an electric blanket. It is hard to explain the reason in the nonvascular group.

In the treatment of acute superficial thrombophlebitis the direct application of heat is advisable, preferably hot moist continuous applications. I do not employ cold at any stage.

I have mentioned briefly that some patients with severe arterial insufficiency are relieved of their pain by the application of cold. In these patients gangrene usually develops, and they require surgical intervention regardless of treatment. Cold as a preoperative form of relief is beneficial but should not be employed with the expectation of saving the limb. Refrigeration of a limb is preferred by some surgeons as a means of preoperative preparation. However, this method is not used in this clinic.

Vascular Exercises. — All patients with peripheral vascular disease are instructed carefully concerning the regular routine use of the Buerger-Allen exercises. The exact value of these exercises as a procedure in increasing peripheral circulation is uncertain. Physiologically this therapy seems sound, and when it is carried out regularly over a long period I feel it is beneficial. In addition to a possible direct circulatory improvement, the exercise serves several other purposes. It promotes rest, keeping patients off their feet longer than they might be otherwise. Patients also become more conscious of their feet and legs and are inclined to follow the principles of good foot hygiene. In addition, the use of a regular form of treatment at home has a good psychologic effect.

Patients should be instructed to carry out the exercises at least twice daily at home. No fixed schedule can be determined ahead of time for all patients. The duration of elevation of the leg is important, and this may vary from fifteen seconds to three minutes. The legs should be elevated until complete blanching occurs but not beyond this point and not to the point of pain. The following two positions of dependency and rest can usually be carried out for two minutes each. Dependency is continued until rubor is complete.

In my experience the oscillating bed as first described by Sanders[2] has been a useful method of treatment. All patients with peripheral vascular disease who have rest pain with or without ulceration are hospitalized and placed on an oscillating bed to be used continuously. It is surprising how quickly patients adjust themselves to the motion. Rest pain may be relieved by this method alone. Edema of the legs when present usually decreases promptly, and this effect alone is helpful. This form of treatment is especially indicated in cases of arteriosclerosis obliterans. This type of treatment has a favorable effect upon the venous circulation, preventing stagnation and reducing the incidence of thrombophlebitis and phlebothrombosis. Bony decalcification associated with prolonged bed rest is also retarded. The oscillating bed is expensive, and therefore its full value cannot always be realized. Clinical results are satisfactory, and this form of treatment is standing the test of time.

Whirlpool. — Favorable results have been noted in various forms of peripheral vascular disorders with this form of treatment. Patients suffering from arteriosclerosis obliterans or thromboangiitis obliterans with simple claudication find the treatment relaxing and comforting. No relief of the claudication may be noted, but the secondary leg fatigue is often helped. In addition, the routine use of a whirlpool bath in such cases promotes excellent foot hygiene. When the arterial insufficiency is advanced and there are areas of ulceration and gangrene, the whirlpool must be used with caution and the temperature of the water carefully computed so it will not rise above 95 F. Small areas of ulceration respond well to whirlpool treatment. Local circulation may be improved and necrotic debris along with crusted areas cleanly removed without trauma. The whirlpool bath seems to be especially effective in the treatment of varicose ulcers and secondary stasis dermatitis.

2. Sanders, C. E.: Cardiovascular and Peripheral Vascular Diseases: Treatment by Motorized Oscillating Bed, J. A. M. A. 106:916 (March 14) 1936.

Pressure Suction Boot Treatment. — This method of treatment has been used widely in peripheral vascular disease since 1933, when it was first reported by Hermann and Reid[3] and Landis and Gibbon.[4] The first reports were optimistic, and it was used widely in the treatment of arteriosclerosis obliterans, thromboangiitis obliterans, Raynaud's disease, frostbite and acute embolic arterial occlusion. The theory of this treatment was based on the hypothesis that alternate exposure of an extremity to a positive and negative pressure increased the blood flow. As a general rule, when the circulation to an extremity is increased there is a definite rise in temperature. Because of the difficulty in applying the cuff properly, it was frequently noted that there was some increased constriction around the thigh and the actual surface temperature frequently decreased rather than increased. This difficulty was overcome by improving the cuff.

Clinical evaluation by most observers now indicates definite limitations for this type of treatment. My colleagues and I continue to use the pressure suction boot treatment in cases of simple arteriosclerosis obliterans with intermittent claudication without ulceration. Although it is extremely hard to evaluate the effectiveness of this form of treatment, we believe that it still is beneficial in this type of case. Our routine has been to submit patients to twenty minutes of whirlpool prior to the pressure suction boot treatment. The boot treatment is carried out from one to two hours daily until a total of twenty-five hours is given. If no change in the clinical picture is noted, the treatment is then discontinued. If improvement is evident, even in a minor degree, we continue until fifty hours of treatment has been given.

The use of this treatment has been limited, and some observers[5] have discontinued it completely. It is well to remember that this therapy is contraindicated in cases of thromboangiitis obliterans, acute or subacute thrombophlebitis or any form of arterial insufficiency in which there is an open ulceration, evidence of cellulitis or any acute or subacute infectious process.

Intermittent Venous Hyperemia. — It was demonstrated some years ago by Lewis and Grant[6] that if a tourniquet was applied to an extremity, occluding the arterial flow for a period of fifteen minutes or more, release of the tourniquet produced a hyperemia. Further observations indicated that this hyperemia was actually an excess being made up as a result of a deficit that had occurred during the period of tourniquet constriction. An apparatus to produce venous stasis and release in cycles was constructed by Collins and Wilensky.[7] They reported favorably concerning the use of this apparatus in the treatment of peripheral vascular disorders.

In our own experience we have not been able to reproduce these results. Neither were Allen[8] and his group at the Mayo Clinic successful in using this apparatus. After a thorough clinical trial over a period of several years, we have discontinued this form of treatment as ineffectual.

Conclusion

The treatment of peripheral vascular disease presents a real challenge to the medical profession. Up to the present time there has been no satisfactory treatment. Obviously, prevention is the ultimate goal, and as yet

3. Hermann, L. G., and Reid, M. R.: Pavaex Treatment of Obliterative Arterial Disease of Extremities, J. Med. **14**:524 (Dec.) 1933.
4. Landis, E. M., and Gibbon, J. H., Jr.: Effects of Alternate Suction and Pressure on Circulation in Lower Extremities, Proc. Soc. Exper. Biol. & Med. **30**:593 (Feb.) 1933.
5. Wright, I. S.: Vascular Diseases in Clinical Practice, Chicago Year Book Publishers, Inc., 1948, p. 136.
6. Lewis, T., and Grant, R.: Reactive Hyperemia in Man, Heart **12**:73 (June) 1925.
7. Collens, W. S., and Wilensky, N. D.: Use of Intermittent Venous Compression in Treatment of Peripheral Vascular Disease, Am. Heart J. **11**:705 (June) 1936.
8. Allen, E. V.; Barker, N. W., and Hines, E. A., Jr.: Peripheral Vascular Disease, Philadelphia, W. B. Saunders Company, 1946.

we have no clew as to the cause of the major peripheral vascular disorders.

Continued attempts will be made to revascularize the extremities, and some success may be anticipated. In the meantime, all available methods must be used.

Physical medical measures are among the most important in the present day treatment of peripheral vascular disease. Until more effective ones are discovered, we must continue to use them intelligently and in conjunction with the accepted medical and surgical procedures.

MEDICAL NEWS

Annual Report of Baruch Comimttee on Physical Medicine and Rehabilitation

Conversion of atomic energy, radar and sonar — the three great physical weapons of World War II — to peacetime applications in the field of medicine has made significant progress, according to the annual report of The Baruch Committee on Physical Medicine.

"The conversion of atomic energy, which 'hastened the defeat of Japan' to radioactive isotopes offers untold possibilities in physiologic research," said Dr. Krusen, who is head of Physical Medicine at the Mayo Foundation, Rochester, Minnesota. "The changing of radar which 'won the battle of Britain' to microwave diathermy promises to become the most effective means of heating bodily tissues. The alteration of sonar which 'aided our supremacy of the seas' to ultrasonics may offer new methods of medical diagnosis and improved procedures in therapy."

The report states that the medical scientists supported by the Baruch Committee are cautious in their observations and have not hesitated to point out the limitations and dangers of these new weapons against disease, but they believe that definite progress has been made in applying these powerful physical forces to benefit rather than to destroy mankind.

Equally significant advances, the report points out, are being made in bringing the advantages of physical medicine and rehabilitation to America's physically disabled. With the availability of new specialized personnel trained in physical medicine and rehabilitation, the report states, there has been a rapid increase in physical medicine and rehabilitation services both in hospitals and in community rehabilitation centers. Most rapid growth of facilities, during the period which the report covers from January 1, 1948 to June 30, 1949, it states, was in the field of cerebral palsy. Numerous centers were started primarily by state and local crippled children's societies affiliated with The National Society for Crippled Children and Adults, either independently or in cooperation with medical schools, public agencies or other voluntary groups. The expansion of such centers in the future to include both children and adults and to serve persons disabled by all types of physical handicaps, the report states, appears likely.

Indications of the increased utilization of physical medicine and rehabilitation as an integral part of medical care and medical teaching, the 188 page report states, are the change in the name of the Council on Physical Medicine in 1949 to the Council on Physical Medicine and Rehabilitation. Another step in achieving a permanent union of physical medicine and rehabilitation was taken in May of this year when the American Board of Physical Medicine, medical specialty board in this field, changed its name to the American Board of Physical Medicine and Rehabilitation. Final step in complete recognition of physical medicine and rehabilitation as a full-fledged medical specialty came this past June when the House of Delegates of the American Medical Association voted to establish within its organization for the first time, a permanent section on Physical Medicine and Rehabilitation.

Evidence of the widespread effect of the activities of the Baruch Committee on professional education in physical medicine and rehabilitation is shown by the fact that up to January 1, 1949, a total of 212 articles on various aspects of physical medicine and rehabilitation had been published in medical and scientific journals with the aid of grants from the committee. These included 50 articles on laboratory research, 85 articles on clinical research, 47 articles on rehabilitation and 30 articles on education in physical medicine.

Founded in 1944 by Mr. Bernard M. Baruch, elder statesman and philanthropist, in memory of his father, Dr. Simon Baruch, pioneer in physical medicine and leading American exponent of hydrotherapy of his time, the committee received an original allocation of $1,100,000 from Mr. Baruch

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ARCHIVES of PHYSICAL MEDICINE

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.·. EDITORIALS .·.

AMERICAN BOARD OF PHYSICAL MEDICINE AND REHABILITATION

The next examinations for the American Board of Physical Medicine and Rehabilitation will be held in Boston, August 26 and 27, 1950. The final date for filing applications is April 1, 1950. Applications for eligibility to take the examinations should be mailed to the Secretary, Dr. Robert L. Bennett, Georgia Warm Springs Foundation, Warm Springs, Georgia.

AMERICAN SOCIETY OF PHYSICAL MEDICINE

Attention is called to those who may want to file applications for consideration for membership in the American Society of Physical Medicine. As of January 1, 1950 all applicants for membership must be certified to the American Board of Physical Medicine and Rehabilitation.

FOR SHORTER SCIENTIFIC PAPERS AND LIVELIER MEETINGS

There is an acute need for shorter scientific papers, according to a recent article by the irrepressible Alvarez.[1] He forcibly expresses many thoughts that must have arisen in the minds of many medical men as a reaction to the plethora in size and number of scientific papers. Alvarez says that today the ablest physicians, whose attention all writers want most to attract, are in the habit of quickly skimming through large numbers of articles, looking always for one thing, the new, significant, important and usable. Without any of the accompanying rehash, this grain of wheat could usually have been reported on a page or two. The worst thing a man can do is to write pages of introduction filled with tiresome statements the truth of which everyone knows, such as that the etiology of the disease under discussion is obscure and that some have said this and some that without getting anywhere. Many writers discourage their readers by inserting early in the paper a page or two on needless statistics or on the technic used. Many a discussion of the literature with a large bibliography should be left out. It would be better to say that a bibliography of several hundred titles is to be found in a recent article by so-and-so, or to write a separate review article. Big tables should usually be left out because so few readers stop to study them, and the cost of setting them is great. Oftentimes the data in several tables could, with great advantage, be shown in a graph or two or could be summarized in a couple of sentences. Alvarez emphasizes that most papers are not injured but improved by shortening and points out that at the recent meeting of the American Medical Association he has heard man after man present a good paper in ten minutes.

1. Alvarez, Walter C.: The Need For Shortening Scientific Papers, Proc. Staff Meet., Mayo Clinic 24:442, 1949.

Besides these aspects presented by Alvarez chiefly from the readers' standpoint, there are a few even more significant ones from the viewpoint of the listener. To get full benefit from a presentation, the audience wants clear diction, speaking directly to it, and the strict observation of the time allotted. Paraphrasing the immortal "Mikado," some of the offenders that "never will be missed" are: the speaker who gazes fixedly at his manuscript and mumbles off monotonously sentence after sentence; the speaker who after consuming the full time for the paper, proceeds to show an endless number of slides, and talks steadily to the screen with his back to the audience; the chairman, who starts his meeting late and "like a good fellow" contentedly allows early speakers to transgress their time considerably with the result that the meeting is ruined for the later speakers and the audience becomes confused and irritated. Perhaps the time will come when no one will be allowed to address or preside over a meeting without a certificate of competency.

Compared to years past, the character and the conduct of the meetings of our American Congress of Physical Medicine have shown marked progress under the careful planning and patient guidance of our present Executive Director and his able Program Committee. In an effort towards further perfection, at a discussion of the meeting of the New York Society of Physical Medicine following the Cincinnati meeting, a few interesting suggestions for the program committee were advanced. Among these were: fewer and shorter papers; separation of didactic papers and original contributions and allowing discussion from the floor for each original paper, so as to enable immediate criticism and ideas from colleagues working in the same field. Such a discussion may be more stimulating to the audience than the cut and dried "official" discussion, provided there is a capable presiding officer. Another suggestion was that since physical medicine rehabilitation is still in the pioneering stage so far as the majority of the medical profession is concerned, it may be worth considering to make at least one-half day at the meetings a "general practitioners" period, presenting papers or round tables of special interest to general practitioners and specialists in other branches, with a question and answer period, similar to the programs instituted recently at the physical medicine sessions at the American Medical Association, and endeavoring through local committees to "bring out" a suitable attendance. As social contact should play an important part in a meeting of members from all over the country, it was suggested that a social hour be held before the annual dinner and a ladies committee be appointed to arrange get togethers of wives. As a matter of fact such a committee has already been nominated. Perhaps the membership at large may have some additional thoughts on this stimulating subject.

THE BRITISH JOURNAL OF PHYSICAL MEDICINE

Beginning January, 1950, the British Journal of Physical Medicine will again come out as a monthly publication, ending eight years of a bimonthly appearance. Despite the handicap of war and postwar "austerity" it has kept going, valiantly serving physical medicine as well as industrial medicine and bringing many noteworthy contributions from both fields. Physical medicine and rehabilitation has made constant progress in Great Britain during these years, and the caliber and number of medical men engaged in it have also notably advanced. We were glad to greet quite a number of our British colleagues here at national and international congresses and in our clinics during the past years. May we wish our sister publication every

possible success in serving the advancement of physical medicine on a larger scope and may we express our hope that the more frequent appearance of the British Journal of Physical Medicine will also further enhance the friendly relations and active cooperation between physiatrists on the two sides of the Atlantic Ocean.

Medical News

(*Continued from page 778*)

with which to further treatment, training and research in the field in which his father was one of the world's leaders. Major goals of the committee have been to: (1) Increase the number of physicians trained to teach and use physical medicine; (2) provide for more extensive basic and clinical research in physical medicine; and (3) insure the proper use of physical medicine in relation to wartime rehabilitation and peacetime physical preparedness.

Of the original allocation, sums totaling $900,000 were given to Columbia University College of Physicians and Surgeons, New York University College of Medicine, and the Medical College of Virginia to estabilsh three centers for research, treatment and training in physical medicine and rehabilitation. The three centers, which are being developed over a 10 year period, are designed to serve as models for medical schools and hospitals both in this country and abroad.

The international influence of the Baruch Committee, the report states, is shown by comments from medical leaders in many nations who have reported directly that new impetus to the advancement of physical medicine and rehabilitation has been gained in their countries from the work of the committee.

In recognition of the international influence of his activities in advancing the cause of physical medicine through the committee, honorary membership in the British Association of Physical Medicine was granted to Mr. Baruch during the year. Stating that many members of the British Association on Physical Medicine had received help from the Baruch Committee, Lord Horder, Physician to the King and President of the British Association said in his letter to Mr. Baruch informing him of this recognition: "The impetus and encouragement which your generosity has afforded physical medicine is of international importance."

In response to the many requests it had received from French readers as a result of an article concerning the work of the committee, the Readers Digest, as a public service, translated and reprinted in French the entire report of the committee's Subcommittee on Civilian Rehabilitation Centers.

Upon receipt of the report, Mr. Baruch announced that his brother, Dr. Herman B. Baruch, former U. S. Ambassador to the Netherlands, has been named honorary chairman of the committee, and that Dr. Frank H. Krusen, Executive Director, has been appointed chairman of the committee to succeed the late Dr. Ray Lyman Wilbur. Dr. Howard A. Rusk, Associate Editor, The New York Times, and Professor and Chairman of the Department of Rehabilitation and Physical Medicine, New York University College of Medicine, has been appointed to serve with Dr. Krusen and Miss Mary Boyle on the committee's administrative board. The name of the committee has been changed to The Baruch Committee on Physical Medicine and Rehabilitation.

At the annual meeting of The National Society for Crippled Children and Adults, Mr. Baruch was awarded the Distinguished Service Medal of The National Society as "the benefactor of many thousands of crippled and handicapped persons through his fostering of research in physical medicine and the establishment of facilities for their treatment and care."

Congress Personals

Dr. Herbert Kent, formerly Fellow in Physical Medicine and Rehabilitation of the New York University-Bellevue Medical Center and National Foundation for Infantile Paralysis, has been appointed Chief of Physical Medicine Rehabilitation at the Veterans Administration Hospital, Indianapolis.

Norman E. Titus, M.D., has been appointed Director of the Department of Physical Medicine at the Chester County Hospital, West Chester, Pennsylvania.

Pennsylvania Academy of Physical Medicine

At a regular monthly meeting of the Pennsylvania Academy of Physical Medicine, October 20, Philadelphia County Medical Society Building, Dr. Joseph Moldaver, Associate in Neurology, Columbia University, New York City, presented a paper on "Recent Advances in Electrodiagnosis and Their Clinical Significance." Officers elected for

the ensuing year were President, Dr. William Schmidt; Vice-President, Dr. H. L. Rudolph and Secretary, Dr. Herman Bearzy.

Recommended Practices for Control of Poliomyelitis

The imminent threat of widespsread infantile paralysis beyond that of previous years has led to the release of statements by specially developed conferences which may well serve as a guide to physicians and the public. The New York City Department of Health on July 25, 1949, emphasized that the incubation period is seven to fourteen days but may be as short as three days or as long as forty-five days. The disease may be spread by (1) contact through discharges from the oropharynx, (2) fecal discharges and (3) flies. Although flies may be contaminated with the virus, reliable evidence is lacking of the spread of poliomyelitis by insects, water, food or sewage. During an epidemic infection is highly prevalent, but only a limited number of cases are clinically identifiable. For every known case between 10 and 100 persons have inapparent infection. Examination of the spinal fluid is an important although not specific diagnosis procedure. The period of greatest communicability is the latter part of the incubation period and the first week of acute illness. At least three groups of strains of poliomyelitis virus are now known, and infection with any one of these may or may not render the person infected immune to attack from the other two. Susceptibility to infection is general. Thus far the known vaccines, drugs, serums or antibiotics are without specific value against the disease.

The expectancy with regard to permanent crippling at the time of onset indicates that about 50 per cent will ultimately emerge free, about 25 per cent will have mild physical limitations, about 15 per cent will have severe crippling and about 5 to 10 per cent will die. Pregnant women are probably not more susceptible to poliomyelitis than other persons. Children born to women who have poliomyelitis during pregnancy or labor are normal. Fatigue in the early stage of poliomyelitis may influence adversely the extent of paralysis. Children should be prevented from becoming overfatigued during the poliomyelitis season.

The National Conference on Recommended Practices for the Control of Poliomyelitis, sponsored by the National Foundation for Infantile Paralysis, Inc., met in Ann Arbor, Mich., in June, 1949 and formulated the following statements with respect to the control of the disease: Poliomyelitis is a highly prevalent infection, and only a small fraction of the cases is clinically identifiable. In its recognizable form it is an acute illness, usually febrile, with early varying symptoms, but usually with headache and almost always a characteristic stiffness of the neck and spine. In about half such cases a lower neuron paralysis develops in the first few days of illness. Diagnosis depends on detection of a flaccid paralysis characteristically irregular in its involvement of muscle or muscle groups. The cerebral spinal fluid shows usually a moderate increase in cells of all types. The period of greatest communicability is covered by the latter part of the incubation and the first week of the acute illness. Isolation should be practiced for one week from the date of onset or the duration of fever if longer than one week. Nose and throat discharges and feces are infectious and should be disposed of as quickly and safely as possible. Quarantine has not been proved valuable in limiting the spread of the disease.

The following points are stressed among the recommended epidemic measures:

1. General notice to physicians of the prevalence or increase of incidence of the disease, description of usual characteristics or onset and necessity of diagnosis and medical care, particularly for bed rest, and information to the public at large on similar matters.

2. Isolation in bed of all children with fever pending diagnosis.

3. Education in such technic of bedside nursing as will prevent distribution of infectious discharges to others from patients isolated at home.

4. Postponement of elective nose or throat operations or dental extractions.

5. Avoidance of excessive physical strain.

6. Avoidance of unnecessary travel and visiting, especially of children, during high prevalence of the infection.

No international measures were recommended.

All obvious and suspected cases should be promptly reported and classified as paralytic or nonparalytic. Diagnostic criteria should generally include three or more of the following: (1) history compatible with poliomyelitis, (2) fever, (3) stiff neck and/or stiff back, (4) 10 to 500 cells per cubic centimeter of spinal fluid taken during the acute or early convalescent period, (5) spinal fluid protein elevated above normal limits and (6) demonstrable muscle weakness or paralysis. In cases in which there is only (1) a history compatible with poliomyelitis and (2) fever, the condition should be classified as presumptive or abortive poliomyelitis.

Patients with acute poliomyelitis are admissible to a general hospital if appropriate isolation precautions are employed. Isolation procedures used for the care of patients with acute poliomyelitis are similar to technics used in the hospital care of other communicable diseases. Patients may be cared for at home if home facilities and medically supervised care are adequate.

Public and private schools should not be closed during an outbreak of poliomyelitis nor their opening delayed except for specific reasons. Schools to which children are transported in buses from widely separated areas or boarding schools, excluding colleges and universities, should delay opening sessions if an outbreak of poliomyelitis exists in the area where the school is located. Summer camps should open as usual un-

less there is an outbreak of poliomyelitis in the area in which the camp is located. Places of recreation and amusement need not be closed; however, the attendance of children at such places should be discouraged.

These recommendations were motivated by the desire to avoid as far as possible the effect of disturbing or altering unnecessarily the normal pattern of life in the community. Whatever is done to upset the usual routine of children in a household or of adults in their habits is likely to bring more trouble than good as far as control of infantile paralysis is concerned. — [Rep. with permission, J. A. M. A. **140**:1276 (Aug. 20) 1949].

Graduate Training at Columbia

Columbia University announces an extension and broadening of its program for Graduate Training in Physical Medicine and Rehabilitation at the Columbia-Presbyterian Medical Center and the Institute for the Crippled and Disabled. A three-year period of broad and intensive training is available to young doctors of high medical caliber who have had at least one year of internship and plan to acquire training in physical medicine and rehabilitation.

The program will start with a brief didactic introduction in the technics and philosophy of physical medicine and rehabilitation, followed by three phases of training:

(a) Clinical experience and responsibility in the practice of physical medicine in the several departments of the Medical Center, and in rehabilitation at the Institute for the Crippled and Disabled.

(b) Periods of clinical training under the Departments of Neurology and Orthopedic Surgery, and in special fields of internal medicine to supplement the students' general experience in those clinical fields where physical medicine plays the greatest role.

(c) Opportunities for research or didactic basic science instruction according to the students' interest and aptitude.

The general plan is to make available to the student of exceptional promise the diversified total resources of the Medical School and its affiliated institutions, and to arrange a flexible program to meet the individual's needs for training.

For the present, three trainees may simultaneously have this opportunity on the three year program. As vacancies are available doctors with incomplete training in physical medicine will be accepted for shorter periods.

Trainees will receive stipends equivalent to $2,500 per year. For one of the three years each Fellow will hold the position of resident in Physical Medicine at Presbyterian Hospital and receive supplementary stipend from the Baruch Gift. For the other years he will be a Baruch Fellow in Physical Medicine and Rehabilitation, supported by the Baruch Gift.

For further information please communicate with Associate Professor Robert C. Darling, Coordinator of Physical Medicine and Rehabilitation, College of Physicians and Surgeons, 630 West 168th Street, New York 32, New York.

Chicago Gets New VA Hospital

Veterans Administration announced it has awarded a $6,985,905 contract for the construction of a 500-bed general medicine and surgical hospital in Chicago. The VA hospital is to be built on a 13-acre site in the medical center district in Chicago's west side. Construction will include a 4,274,000 cubic-foot main hospital building, recreation hall, chapel, nurses and attendants quarters, boiler house, radial brick chimney, steel flag pole, electrical substation and connecting corridor.

Grant for Cerebral Palsy Training

Alpha Chi Omega, national women's fraternity, has voted an additional grant of $10,000 to the National Society for Crippled Children and Adults, the Easter Seal agency, to continue a jointly sponsored scholarship program for training much-needed professional personnel to work with the cerebral palsied.

Apparatus Accepted

Vacolite Model J Hearing Aid. — Contains microphone, amplifier and batteries in a single metal case. Crystal and magnetic types of receiver available. The Council on Physical Medicine and Rehabilitation voted to include the instrument in its list of accepted devices.

Televox Model E Hearing Aid. — Single unit device containing microphone, amplifier and batteries. The Council on Physical Medicine and Rehabilitation voted to include the instrument in its list of accepted devices.

RV 6-Watt Portable Black Light. — Convenient source of ultraviolet light for diagnostic purposes. The Council on Physical Medicine and Rehabilitation voted to include the instrument in its list of accepted devices.

Radioear Permo-Magnetic Hearing Aid (Multipower Model). — Electronic three tube instrument comes in two pieces (batteries separate). Instrument equipped with "Phonemaster" coil with which voice signals from telephone may be picked up inductively, amplified through the instrument, and reproduced in either the air or bone conduction receiver. The Council on Physical Medicine and Rehabilitation voted to include the instrument in its list of accepted devices.

Wall Model Aero-Kromayer Lamp. — Source of ultraviolet radiation so designed that control box is supported on wall bracket and connected by cable with lamp and lamp housing. The Council on Physical Medicine and Rehabilitation voted to include the lamp in its list of accepted devices.

Fischer Table Model 200 Short Wave Diathermy Unit. — Intended for applying heat to tissues and designed to generate wavelengths of approximately 11 meters without use of crystal control. The Council on Physical Medicine and Rehabilitation

voted to include the instrument in its list of accepted devices.

Beltone Symphonette Model Hearing Aid. — Three tube air conduction hearing aid with batteries contained in amplifier case. Bone conduction is also available. The Council on Physical Medicine and Rehabilitation voted to include the instrument in its list of accepted devices.

Stephenson Resuscitator, Physicians and Office Models. — Portable devices for delivering oxygen, under alternating positive and negative pressure, to a patient by means of a mask. Can be used as resuscitator, inhalator or aspirator. The Council on Physical Medicine and Rehabilitation voted to include both models in its list of accepted devices.

McKesson Resuscitator and Inhaler. — Designed to administer oxygen to apneic patients. Oxygen supplied either by intermittent positive pressure or by continuous flow at low pressure. The Council on Physical Medicine and Rehabilitation voted to include the instrument in its list of accepted devices.

Unex Midget Hearing Aids, Models 95 and 110. — These hearing aids contain microphone, amplifier and batteries in a single metal case. The Council on Physical Medicine and Rehabilitation voted to include the models in its list of accepted devices.

Atomic Energy Commission

Carroll L. Wilson, General Manager of the Atomic Energy Commission, has announced the appointment of two new branch chiefs to the AEC's Washington headquarters staff. The new appointees are Dr. Walter D. Claus, chief of the Biophysics Branch, Division of Biology and Medicine and Dr. Joseph B. Platt, chief of the Physics Branch, Division of Research.

The Physics Branch of the AEC Division of Research is a new office establishment to administer the AEC research program in the field of physics.

Approval of the proposals was recommended in each case by the AEC Advisory Committee on Biology and Medicine.

The award of contracts to the 18 institutions involved will bring to a total of 150 the number of AEC-supported research projects being carried on in medicine, biology, cancer studies and biophysics at universities, hospitals and research centers. Approximately $5,000,000 has been earmarked by the AEC for support of such research in non-government agencies during fiscal year 1950.

Air Force Medical Service Announces Organization

Final reorganization of the Office of The Surgeon General, U. S. Air Force, has been completed, according to an announcement made by Major General Malcolm C. Grow, The USAF Surgeon General. The Department of the Air Force was provided with its own medical service on May 13th by direction of Secretary of Defense, Louis Johnson. The Medical service formerly had been under Army control.

General Grow has named Major General Harry G. Armstrong as Deputy. Major General George R. Kennebeck is Chief of the Dental Service, and Brigadier General Dan C. Ogle, is Special Assistant to The Surgeon General.

The Office of The Surgeon General is divided into three directorates in order to afford better flexibility and control for Air Force medical services, and to meet all the medical and allied requirements. The directorates, with the divisions and branches, are as follows:

Directorate of Professional Services —
Aviation Medicine Division:
Psychological Medicine Branch
Aviation Physiology Branch
Protective Equipment Branch
Aircrew Maintenance Branch

Physical Standards Division:
Induction and Appointment Branch
Physical Fitness Branch
Aircrew Standards Branch
Disposition and Retirement Branch

Medical Research Division:
Research Policy Branch
Scientific Liaison Branch
Medical Intelligence Branch
Scientific Review Branch
Technical Information Branch

Clinical Medicine Division:
Surgery Branch
Internal Medicine Branch
Neuropsychiatry Branch
General Medical Practice Branch
Rehabilitation Branch

Preventive Medicine Division:
Preventable Disease Branch
Environmental Sanitation Branch
Epidemiological Branch
Veterinary Branch
Biological Defense Branch
Health Indoctrination Branch

Directorate of Staffing and Education —
Veterinary Corps, USAF
Air Force Nurse Corps
Medical Service Corps, USAF
Women's Medical Specialist Corps, USAF

Management Division:
Procurement Branch
Career Monitoring Branch
Classification and Assignment Branch

Professional Education Division:
Medical Education Branch
Technical Schools Branch
Medical Training Publications Branch

Directorate of Plans and Hospitalization —
Medical Service Plans Division:
Plans Branch
Troop Unit and Organization Branch
Management Planning Branch

Hospital and Evacuation Division:
Operations and Evacuation Branch
Hospital Fund Branch
Construction Standards and Inspection Branch

Medical Materiel Division:
Distribution Branch
Development and Equipment Allowance Branch
Requirements and Stock Control Branch
Supply Planning Branch

Resources and Analysis Division:
Medical Personnel Requirements Branch
Facilities Planning and Analysis Branch
Program Requirements Branch

Biometrics Division:
Procedures Branch
Sick and Wounded Branch
Morbidity Branch (Health Statistics)

The Office of The Surgeon General will supervise all medical activities of the Air Force, including operation of hospitals at Air Force bases in the continental United States and in overseas areas. It will also render technical supervision over the School of Aviation Medicine, Randolph Air Force Base, Randolph Field, Texas; the Aero-Medical Laboratory, Wright-Patterson Air Force Base, Dayton, Ohio; and the Arctic Aero-Medical Laboratory, Ladd Air Force Base, Alaska.

The Air Force Medical Service is participating in joint staffing of Army general hospitals and other joint Army medical activities, including recruiting stations, the Armed Forces Institute of Pathology, the Army Medical Center, Central Dental Laboratories, Medical General Dispensaries, the Medical Nutrition Laboratory, and the Armed Forces Medical Procurement Office.

The personnel named to key positions in The Office of The Surgeon General are men of proved professional and administrative ability. Pioneers in the comparatively new field of aviation medicine, these officers are well-qualified for the positions they hold.

National Survey to Establish Incidence of Multiple Sclerosis

The National Multiple Sclerosis Society is conducting a nationwide fact-finding program aimed at obtaining figures on the incidence of multiple sclerosis. The first project was a statistical survey in the city of New Orleans and vicinity conducted on a grant made by the society to Tulane University. The survey has been completed and results are now being tabulated and evaluated. Similar projects are under way in the San Francisco and Denver areas supported by grants made to Stanford University and the University of Colorado. Parallel surveys in cooperation with the U. S. Public Health Service are planned for Minneapolis and Boston, all to be completed this year. It is expected that the survey results will allow a reasonably accurate estimate of the number of multiple sclerosis cases in the United States.

Cleveland Rehab Groups Sponsor Limbs Clinic

A prosthetic clinic, sponsored by Possibilities Unlimited and the Cleveland Academy of Medicine, was held at the Academy of Medicine on November 16. Maj. Gen. Norman T. Kirk, former surgeon general of the United States Army, was the principal speaker.

The main purpose of the clinic was to demonstrate to physicians the advantages and technics connected with the wearing of an artificial limb. Following the formal talks, there was a demonstration of amputees wearing various kinds of artificial limbs. A commentator described each limb and its special uses. The clinic, although primarily organized for doctors, was open to rehabilitation workers, therapists, nurses, and amputees.

Meeting of American Academy for Cerebral Palsy

The American Academy for Cerebral Palsy announces that its annual meeting will be held in New York City at the Waldorf-Astoria Hotel on Friday and Saturday, February 17 and 18, 1950, immediately following the meeting of the American Academy of Orthopaedics.

Scientific sessions will be open to visiting orthopaedic men and any other physicians interested in the problem of cerebral palsy. These sessions will be on Friday, February 17th, from 2:00 to 5:00, and on Saturday morning, February 18th, from 9:00 to 12:00. All phases of cerebral palsy will be discussed.

AEC Announces New Appointments in Biology and Medicine Division

Carleton Shugg, Deputy General Manager of the U. S. Atomic Energy Commission, announced the appointment of Dr. Paul B. Pearson as acting chief of the Biology Branch, Biology and Medicine Division, of the Commission.

Mr. Shugg also announced two appointments to the Medical Branch of the Biology and Medicine Division. They are Dr. Charles Little Dunham and Dr. George A. Hardie.

BOOK REVIEWS

ELECTROTHERAPY AND LIGHT THERAPY WITH ESSENTIALS OF HYDROTHERAPY AND MECHANOTHERAPY. By *Richard Kovács*, M. D., Professor of Physical Medicine, New York Polyclinic Medical School and Hospital; Attending Physical Therapist, Manhattan State, Harlem State and Columbus Hospitals; Visiting Physical Therapist, New York City Department of Correction Hospitals; Consulting Physical Therapist, Mary Immaculate Hospital, Jamaica, N. Y., St. Charles Hospital, Port Jefferson, L. I., Alexian Brothers Hospital, Elizabeth, N. J., Area Consultant in Physical Medicine, Veterans Administration, Consultant, Office of Surgeon General, Army Department. Sixth Edition. Cloth. Price, $10.00. Pp. 739, with 368 illustrations and 1 Plate in Color. Lea & Febiger, Washington Square, Philadelphia 6, 1949.

Many have been waiting for the release of this new edition of Kovács' book. With the numerous advancements and developments in the field of physical medicine this latest volume was a necessity. As would be anticipated Dr. Kovács did an admirable job in bringing the information up to date. Many chapters have been rewritten and revised, for example, the chapter on currents of low frequency includes the latest and important ideas on the physiology and application of these currents; a section considers the experimental and clinical material on the microwave diathermy, and other sections discuss the latest contributions on ultrasonics, infrared radiation, ultraviolet irradiation and electrodiagnosis.

This work has received such universal acclaim that the commendations and recommendations of a reviewer are superfluous; certainly this is obviously true for the readers of the *Archives of Physical Medicine*. The mere announcement that the sixth edition of Kovács' book is off the press should be sufficient reason for the sale of the book to every physiatrist worthy of the title and everyone else even remotely interested in physical medicine. This book has the position in the literature about physical medicine that Cecil's work has for internal medicine, Best and Taylor's for physiology or Sollmann's for pharmacology.

If there should be anyone, although this seems almost impossible, who has not seen or used one of the earlier editions of this work or who has not seen or heard of Dr. Kovács, this new edition can be highly recommended as one of the best and the most recent books on physical medicine.

A MANUAL OF PHYSICAL THERAPY. By *Richard Kovács*, M.D., Professor of Physical Medicine, New York Polyclinic Medical School and Hospital; Attending Physical Therapist, Manhattan State, Harlem State and Columbus Hospitals; Visiting Physical Therapist, New York City Department of Correction Hospitals; Consulting Physical Therapist, Mary Immaculate Hospital, Jamaica, N. Y., St. Charles Hospital, Port Jefferson, L. I., Alexian Brothers Hospital, Elizabeth, N. J., Area Consultant in Physical Medicine, Veterans Administration, Consultant, Office of Surgeon General, Army Department. Fourth Edition. Cloth. Price, $3.75. Pp. 328, with 124 illustrations. Lea & Febiger, Washington Square, Philadelphia 6, 1949.

The revision of the author's larger and more comprehensive volume, "Electrotherapy and Light Therapy," reviewed above, also prompted a new edition for this manual. This popular work which has been helpful to sturents, nurses, physical and occupational therapy technicians has been enlarged and rewritten to include the latest information on all the subjects in physical medicine. This book serves a very useful purpose as a concise and practical application of the subject.

THE PHYSICIAN'S BUSINESS, PRACTICAL AND ECONOMIC ASPECTS OF MEDICINE. By *George D. Wolf*, M.D., Assistant Clinical Professor, Otolaryngology, New York Medical College; Fellow, New York Academy of Medicine; Fellow, American Medical Association. With foreword by Harold Rypins, A.B., M.D., F.A.C.P. Third Edition. Cloth. Price, $10.00. Pp. 563, with 96 illustrations. J. B. Lippincott Co., East Washington Square, Philadelphia 5, 1949.

This is the third edition of a work which first appeared in 1938. This edition recognizes the changes that have taken place and are altering the private practice of medicine and are to be noted in the rewriting of many chapters. The physician-patient relationship which has existed for many, many years is being transformed rather rapidly. It is being influenced not only by the encroachment of the government and its various agencies but by social and economic factors of the patients and by the changing philosophy of the medical profession itself. The author appreciates this new concept and has brought the book up to date by incorporating these ideas.

This is a complete book in every way on medical economics. Suggestions are given to the young physician starting in practice and for the older physician in improving his practice. It is divided into seven sections as follows: the doctor in the making, the management of a medical practice, technics, professional contacts, the doctor and the law, finances and social medicine. Items pertaining to physical medicine include the arrangement of the physician's office for providing space for physical therapy, the fee schedule of the Veterans Administration for physical and occupational therapy and home exercises for the feet, shoulder, back, etc.

A book of this type could be read profitably (and that does not necessarily mean for financial gain) at regular intervals by most practicing physicians. His professional work would be simpler and more orderly and he would be happier and wiser.

The price of the book seems high. Perhaps the advice given in the text as to fees may be the guide, which reads as follows: "as a rule, it is poor practice for the physician to undercharge . . . often the large size of a man's fee increases his prestige." It would be a loss to those who need and would benefit by reading it if the price of this worthy book prevented its purchase.

THE CAUSATION AND TREATMENT OF DELAYED UNION IN FRACTURES OF THE LONG BONE. By *Kenneth W. Starr*, O.B.E., E.D., M.B. (Syd.), M.S. (Melb.), F.R.C.S. (Eng.), F.A.C.S., F.R.A.C.S., Surgeon, Sydney Hospital, New South Wales; Visiting Surgeon, Concord Military Hospital; Consulting Plastic Surgeon, Faculty of Dentistry, University of Sydney; Member of the Court of Examiners, Royal Australasian College of Surgeons; Lt. Col. (R. of O.), A.A.M.C., late Officer Commanding Surgical Division. Cloth. Price, $12.50. Pp. 215, with 106 illustrations. Butterworth and Co. (Publishers), Ltd., Bell Yard, Temple Bar, London, 1947.

This monograph is the Jacksonian Prize Essay of 1944 awarded by the Royal College of Physicians. It is divided into three parts: Part I, The Morphogenesis of Bone; Part II, The Healing of Fractures; Part III, Aetiology and Treatment of Delayed Union. More than half of the book considers the anatomy and chemistry of bone and the physiologic processes in bone repair. These sections are excellent, well organized, documented and illustrated. The last part which is concerned with the actual treatment of delayed union of fractures is too academic to be practical. If, in the selection of the title, the word "treatment" had been omitted, the book would be more likely to attract the attention of the physiologists and students (i. e., postgraduate) who would find much condensed information, not only about fractures but about the normal and pathologic structure and physiology of bone. Just why the author thought it necessary to open each chapter with a poetic or classical excerpt, including two in German, is difficult to understand.

LECTURES ON THE PHYSIOLOGY OF EXERCISE. By *Arthur H. Steinhaus*, Professor of Physiology, George Williams College, Chicago. Copyright. Paper. Pp. 23. Price, $1.00. Published and Distributed by the Author, 5315 Drexel Avenue, Chicago 15, 1948.

This is a short discussion of the physiology of exercise. It is worth reading. It contains the physiologic basis of fitness; the anatomy, physiology and development of strength; muscle blood supply as related to muscle function; heat, circulation and respiration in relation to exercise and endurance; tonus, posture, muscle sense, physiologic and psychologic aspects of tension and the problem of relaxation; and nutrition in physical fitness.

A LIVING ANATOMY. A PHOTOGRAPHIC ATLAS OF MUSCLES IN ACTION AND SURFACE CONTOURS. By *R. D. Lockhart*, M.D., Ch.M., Regins Professor of Anatomy, University of Aberdeen, Formerly Professor of Anatomy, University of Birmingham; Examiner in Anatomy to the Universities of Aberdeen, Birmingham, Glasgow, Manchester, St. Andrews and Sheffield, the Conjoint Board of the Royal Colleges of Physicians and Surgeons and the Chartered Society of Physiotherapy. Cloth. Pp. 71, with 149 illustrations. Price, $4.00. Oxford University Press, 114 5th Ave., New York 11, 1948.

This book is an anatomical study containing photographs of the living subjects. It does kindle the student's enthusiasm in examining the living body for himself to divert him from textual descriptions. He will learn more quickly and more confidently, by studying the living muscles in action.

For the most part the muscles are shown in action by the resistance of movement between the model and the demonstrator, or between two models. The different models and the different aspects also interest students in the fact of individual variation both in physique and function.

THE HOSPITAL BUILDING: COMPRISING THE 1947 A. I. A. CONVENTION SEMINAR ADDRESSES ON HOSPITALS, AND THE BUILDING TYPE REFERENCE GUIDE No. 2. Reprinted from the Bulletin of the American Institute of Architects, May, 1947, and January, 1948. Compiled and edited by *Walter F. Taylor*, Director, Department of Education and Research, The American Institute of Architects, Washington, D. C. Paper. Price, $2.00. Pp. 71, with 7 illustrations. Department of Education and Research, The American Institute of Architects, the Octagon, Washington 6, D. C., 1947-1948.

This comprises the 1947 A. I. A. Convention Seminar addresses on Hospitals and the Building Type of Reference Guide No. 2, reprinted from the Bulletin of the American Institute of Architects, May, 1947, and January, 1948.

AN INDEX OF TREATMENT BY VARIOUS WRITERS. Edited by *Sir Robert Hutchison*, Bt., M.D., LL.D., F.R.C.P., Consulting Physician, London Hospital, and Hospital for Sick Children, Great Ormond Street; assisted by *Reginald Hilton*, M.A., M.D., F.R.C.P., Physician to St. Thomas' Hospital; Consulting Physician, Epsom Hospital; Consulting Physician and Cardiologist, Wembley Hospital. Cloth. Thirteenth Edition, revised. Pp. 972. Price: $17.50. The Williams and Wilkins Co., Mt. Royal & Guilford Avenues, Baltimore 2, 1948.

It is difficult to review in its entirety a book of

this exhaustive scope. Seventy-four contributors have covered the field of medical therapeutics in compact form, but with sufficient detail to provide the general practitioner with a useful guide to up-to-date therapeutics. Physical Medicine has not been neglected except that passive measure such as electrotherapy and hydrotherapy receive more attention than therapeutic exercise. Modern concepts of medical rehabilitation, however, are covered surprisingly well. This is certainly a valuable book and a popular one, as the printing of thirteen editions attests.

PROBLEMS IN THE FITTING AND SERVICING OF PROSTHETIC DEVICES FOR ABOVE-THE-KNEE AMPUTEES. Prepared for Office of Naval Research, Special Devices Center, Sands Point, L. I., New York. Project No. 80. Report No. 80.12. Contract N6 ONR-279. Research Division, College of Engineering, New York University, 1948.

The report is based on data collected from questionnaire surveys of three groups involved in the problem, including 128 above-the-knee amputees, 68 orthopedic surgeons, and 60 limb-makers. The comparative study of the response to the questionnnaires is of interest in that it revealed that each group considered essentially the same problems in fitting and servicing prosthetic devices to be of primary importance, but there was minimal cooperation between the three groups to improve the situation. Instead, it appeared that each group was attempting to dominate the other two in supervising proper handling. Another point brought out in the survey is that there is a tremendous need for an adequate training program for amputees, but no suggestions were offered on how to remedy the situation.

EDUCATION THROUGH PHYSICAL ACTIVITIES: Physical Education and Recreation for Elementary Grades. By *Pattric Ruth O'Keefe*, Ph.D., Director of Health and Physical Education, Kansas City, Missouri, Public Schools, and *Helen Fahey*, A.M., Supervisor of Health and Physical Education, Kansas City, Missouri, Public Schools. Cloth. Pp. 309, with illustrations. Price, $4.00. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, 1949.

Although it has been generally recognized and accepted for many years that physical education for the elementary school child is indispensable to proper growth and development, there has been only recently a trend to begin physical education activities in the early elementary school rather than in the secondary school. This volume describes an elementary physical education program at the elementary school level and contains desirable activities, practices, and procedures in a form rendering it useful to administrators, elementary school classroom teachers and specialized physical education teachers. After an introduction on the fundamental principles underlying the program Part I and Part II present Outdoor and Indoor Activities. The methods of conducting outdoor activity include flexible plans that can be applied in most school situations. Indoor programs, including gymnasium, classroom and playrooms are designed to help teachers develop the best programs for primary and upper elementary school children.

Part III of the book is devoted to special events. It deals with play days, pageants and other types of special programs which have come to be an important phase of physical education programs. This book should be valuable as a textbook in teacher-training courses for elementary school classroom teachers in physical education.

YOUR COUGHS, COLDS AND WHEEZES. By *Joseph D. Wassersug*, M.D. Cloth. Pp. 277. Price, $2.95. Wilfred Funk, Inc., 227 E. 44th St., New York 17, 1949.

The author of this readable volume is an internist of good standing. He is giving a fairly completely informative, popularly written account of all the various common respiratory ailments. Starting with colds, their prevention and treatment, he discusses influenza, pneumonia, tuberculosis of the lungs, the various forms of asthma, lung cysts and growths and ends with a chapter on the cigarette cough. Each chapter ends with ten questions on a true or false check list which should add to the better comprehension of the points emphasized. This volume can be profitably read, not only by the laity but also by medical men and their assistants.

THE SCIENCE AND ART OF JOINT MANIPULATION. By *James Mennell*, M.A., M.D., B.C. (Cantab.), etc., Consulting Physician in Physical Medicine, St. Thomas's Hospital, and former Lecturer to the Physiotherapy Training School; Hon. Fellow Chartered Society of Physiotherapy; one time visiting Associate Professor of Physical Medicine, University of Southern California; Awarded the Golden Keys with Life Membership of The American Congress of Physical Medicine and The American Physical Therapy Association. Vol. I — The Extremities. Second edition. Cloth. Pp. 215, with 299 illustrations. Price, $7.50. The Blakiston Company, 1012 Walnut St., Philadelphia 5, 1949.

Physicians interested in the diagnosis and treatment of skeletal disorders and in particular physiatrists have much to learn from this splendid book of Dr. Mennell's.

In his long experience in the field of manipulation he has learned details of intimate joint anatomy of functional significance not realized by many. On a basis of his keen observations and his own personal skill in technic of manipulation, he is in a position to instruct us in a subject little understood and rarely practiced in this country by physiatrists or orthopedists. In this book he presents the details of the technic and art of manipulation as well as is possible by words, with the help of photographs and drawings which are numerous and of good quality.

Those who are familiar with the first edition will find no great changes, although new illustrations have been added, particularly in relation to the shoul-

der. Although it is not the purpose of the book to discuss clinical indications and results, some illustrative case histories would be welcomed. This is a worthy addition to the library of all physiatrists.

ON THE TRANSMISSION THROUGH SKIN OF VISIBLE AND ULTRAVIOLET RADIATION. By *K. G. Hansen.* Paper. Pp. 106. Copenhagen, Nyt Nordisk Forlag, Arnold Busck, 1948.

The author presents new data on the absorption of various wavelengths of visible and ultraviolet radiation by the skin of the mouse and of man. The opening chapters review the histology of normal murine and human skin, the methods of generating the desired radiations, and the results of previous investigators. Two series of experiments are then described, one with photographic methods and filtered radiation, the other with a monochromator and selenium barrier-layer cell. They show that transmission decreases uniformly with wavelength as one moves from 500 to 300 millimicrons except for a minimum at 415 which is shown to be due to hemoglobin. Otherwise the author finds nothing to indicate that in the range from 500 to 300 millimicrons there is anything to which a specific biological effect can be ascribed. The text is in English, with a two-page summary in Danish at the end. It is recommended to research workers as scholarly in quality and fundamental in importance.

THANK GOD FOR MY HEART ATTACK. By *Charles Yale Harrison.* Pp. 144. Cloth. Price, $2.50. Henry Holt & Co., Inc., 257 Fourth Ave., New York 10, 1949.

This is the work of a distinguished novelist who had suffered a heart attack and who describes his experience of recovering in an instructive and interesting manner, with the medical facts checked by competent authority. It is an encouraging and clear account, which should be of considerable interest, not only to laymen but also to physicians and nurses. The recital, the reaction of an intelligent patient to the various incidents during the course of a long illness, the need for remembering some simple, old-fashioned truths without adhering strictly to textbook rules and finally the patient's search and analysis of many questions and problems related to heart disease make this story particularly stimulating reading.

THE AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS INSTRUCTIONAL COURSE LECTURES. Volume V, 1948. Edited by *Walter P. Blount,* M.D., and *Sam W. Banks,* M.D. Cloth. Pp. 330. Price: $7.50. Edwards Brothers, Inc., 300 John St., Ann Arbor, Michigan, 1948.

This latest volume of instructional course lectures lives up to, or surpasses, the high quality of those previously published. A great variety of common orthopedic problems are discussed such as: feet, low back pain, scoliosis, internal fixation of fractures, painful hips and arthritis. Some other chapters deal with vascular tumors and abnormalities, plastic and hand surgery, surgical treatment of poliomyelitis and muscle physiology. The illustrations are profuse and uniformly good. This is an exceptionally valuable book for orthopedists in training and of interest also to the physiatrist and as a refresher course for older surgeons. No attempt is made to cover the subjects in their entirety, but fundamental principles of diagnosis and treatment are discussed and the most up-to-date procedures of proven value are presented in detail by men of outstanding reputation.

NUTRITION AND PHYSICAL FITNESS. By *L. Jean Bogert,* Ph.D. Formerly Instructor in the Department of Medicine, University of Chicago; Instructor in Experimental Medicine, Yale Medical School, and Lecturer in Chemistry, Connecticut Training School for Nurses, New Haven; Professor of Food Economics and Nutrition, Kansas State Agricultural College, Manhattan; Research Chemist, Obstetrical Department, Henry Ford Hospital, Detroit. Fifth Edition. Cloth. Pp. 610, with 96 illustrations. Price, $4.25. W. B. Saunders Company, West Washington Square, Philadelphia, 1949.

This book deals with the discovery of new vitamins and a clarification of the roles they play in metabolism. The chapter on Food Economics includes a discussion of the foods giving the best return in nutritive factors at low cost, with charts illustrating the relative cost of calories, protein, calcium, iron and vitamins A, B, and C. New chapters and sections have been added to previous editions on milk and milk products, fruits and vegetables and alcoholic beverages. A new feature of this edition is the inclusion of questions, problems and suggested readings.

THE KINESIOLOGY OF CORRECTIVE EXERCISE. By *Gertrude Hawley,* M.A., formerly Head of Corrective Gymnastics at Stanford and Northwestern Universities. Fabrikoid. Pp. 192. Second edition, thoroughly revised with 107 illustrations. Lea & Febiger, 600 S. Washington Square, Philadelphia 6, 1949.

This is the second edition of a textbook of kinesiology for those with special interests in corrective exercise. In this revision the material has been arranged with subject and page headings to facilitate finding specific topics. Functional anatomy from the corrective standpoint is dealt with in Part I, and detailed analyses of typical corrective exercises, preceded by brief chapters on physiology, posture standards, and group treatment are included in Part II and appendix. This book will be particularly valuable to the teacher and student of remedial exercise.

TEACHING POSTURE AND BODY MECHANICS. By *Ellen Davis Kelly,* Ph.D. Cloth. Pp. 212. Price, $3.75. A. S. Barnes and Company, Inc., 101 Fifth Avenue, New York 3, 1949.

The broad problem of organizing and executing effective programs of posture training for the preadolescent and adolescent age groups is admirably presented in this monograph. In Part I are included methods of teaching and the factors influencing posture. Part II considers organization and supervision, home-school-community relationships, and methods of posture analysis in large groups. Various

stunts and games to create posture awareness and specific exercises to strengthen musculature are presented in Part III and appendix. The text is adequately documented with references to the literature. Although this book is intended primarily for teachers and parents, it will be a valuable addition to the library of physiatrists participating in programs of posture education.

NURSING CARE OF NEUROSURGICAL PATIENTS. By *Roland M. Klemme,* M.D., F.I.C.S., F.A.C.S., Professor of Surgery, Saint Louis University School of Medicine, Saint Louis, Missouri. Cloth. Pp. 117. Price, $3.00. Charles C Thomas, 301-327 East Lawrence Avenue, Springfield, Illinois, 1949.

This text is intended only as a manual of instruction for nurses and is based primarily on the wide personal experience of the author, a prominent neurosurgeon. As a background, one chapter is devoted to neuroanatomy, and another to fundamental signs and symptoms of neurosurgical conditions. The bulk of the monograph is devoted to nursing technic including that of the operating room. It is well illustrated and printed and should be a valuable addition to nurses' training school libraries.

CARDIAC CATHETERIZATION IN CONGENITAL HEART DISEASE. By *André Cournand,* M.D., Associate Professor, Department of Medicine, College of Physicians and Surgeons, Columbia University; *Janet S. Baldwin,* M.D., Assistant Professor, Department of Pediatrics, New York University, College of Medicine, and *Aaron Himmelstein,* M.D., Instructor, Department of Surgery, College of Physicians and Surgeons, Columbia University. First edition. Price, $4.00. Pp. 108, with 17 illustrations. New York: Commonwealth Fund, 1949.

The technic of right heart catheterization is becoming increasingly important in clinical medicine in the last few years. This book is an authoritative survey of the methods used and the results obtained. The most important place of this book in the literature of physical medicine is that it is a good description of a physiologic technic which can be applied to the human patient. It opens up new studies of the circulation that have not been possible in any other previous way. It would seem to this reviewer that every specialist in physical medicine who is interested in studies in circulation should familiarize himself with the method described in this book. It will be possible for those who are looking for new developments to see numerous ways in which the methods described in this book can be applied. The possibilities of bringing measuring instruments into the circulation and even into the heart opens up wide possibilities, and, by the use of fine recording instruments of different physical properties one might well expect that the method of catheterization will open an entire new field of physical study of the circulation.

NEW AND NONOFFICIAL REMEDIES, 1949, CONTAINING DESCRIPTIONS OF THE ARTICLES WHICH STAND ACCEPTED BY THE COUNCIL ON PHARMACY AND CHEMISTRY OF THE AMERICAN MEDICAL ASSOCIATION ON JANUARY 1, 1949. Issued Under the Direction and Supervision of the Council on Pharmacy and Chemistry of the American Medical Association. Cloth. Price, $3.00. Pp. 800. J. B. Lippincott Co., Philadelphia 5, 1949.

Over the years since the first edition of this reference work appeared, the book has come to occupy a place of importance in the library of every person who is concerned with medical therapy and desires to keep abreast of new developments in the field. The present edition is larger than its predecessors and contains a wealth of valuable information regarding remedies which are too new to be official, and regarding acceptable dosage forms of official preparations, but much of its effectiveness is lost by an incredibly inaccurate index and other slips due to careless editing.

A TEXTBOOK OF PHYSIOLOGY. Originally by William H. Howell, M.D. Edited by *John F. Fulton,* M.D., Sterling Professor of Physiology, Yale University School of Medicine. With the Collaboration of Donald H. Barron; John R. Brobeck; Robert W. Clarke; George R. Cowgill; Paul F. Fenton; William U. Gardner; Samuel Gelfan; David I. Hitchcock; David P. C. Lloyd; Leslie F. Nims; Theodore C. Ruch, and Jane R. Russell. Sixteenth Edition. Pp. 1258, with illustrations. Price, $10.00. W. B. Saunders Company, West Washington Square, Philadelphia 5, 1949.

In this new sixteenth edition obsolete material, both in the text and in the illustrative matter has been deleted. The most extensive addition lies in Dr. Jane Russell's chapters on the endocrines which bring into physiologic perspective the recent biochemical developments in the sphere of metabolism and the ductless glands. The section on the electrocardiogram has been completely rewritten by Drs. Nahum and Chernoff who describe the newer work on unipolar ECGs, the interpretation of chest leads, and some general principles of electrocardiographic interpretation. Other new chapters are those on the gastrointestinal tract prepared by Dr. Paul F. Fenton with the cooperation of Dr. Cowgill. Dr. Samuel Gelfan, an experienced muscle physiologist, has contributed a separate chapter on muscle, and Dr. Livingston an account of the cerebrospinal fluid. Dr. Theodore C. Ruch has written the concluding chapter on the physiology of micturition. This edition has been reset in the readable Times Roman typeface with a slightly longer line and longer page than in the previous edition. It hardly need be mentioned that this book undoubtedly is today recognized as the outstanding textbook on physiology.

PHYSICAL MEDICINE ABSTRACTS

Radioactive Isotopes in the Study of Peripheral Vascular Disease: I: Derivation of a Circulatory Index. Morris T. Friedell; Fenton Schaffner; William J. Pickett, and Irvin F. Hummon, Jr.

Arch. Int. Med. **83**:608 (June) 1949.

Methods of determining the peripheral blood supply, with a consideration of the use of radioactive isotope tracers in this problem, are discussed. The present study may be summarized as follows: One hundred patients from the wards of the Cook County Hospital were each given an intravenous injection of 20 microcuries of P^{32}, and the "build-up" curves indicating deposition of the radioactive isotope were determined. A semilogarithmic plotting of these curves resulted in what was essentially a straight line; the reciprocal of its slope was considered the index of circulation. These indexes fell into a normal distribution pattern, and the patients with arteriosclerosis and those over 30 years of age fell into well defined groups. The diffusion of P^{32} into the tissues was faster in older and in arteriosclerosis patients. Capillary dilatation is thought to be the chief cause of this phenomenon; observations of previous workers on capillary dilatation and stasis are discussed. The concept that stasis due to capillary dilatation, rather than vascular spasm, is responsible for the signs and symptoms of peripheral arteriosclerosis is presented; variations in the index will be presented in a subsequent communication, and the diagnostic and prognostic significance of variations in the index will be discussed.

Radioactive Isotopes in the Study of Peripheral Vascular Disease: II—Method of Evaluation of Various Forms of Treatment. Fenton Schaffner; Morris T. Friedell; William J. Pickett, and Irvin F. Hummon, Jr.

Arch. Int. Med. **83**:620 (June) 1949.

The derivation of an index of circulation, calculated from the rate of diffusion of intravenously injected radioactive phosphorus into the tissues of the lower extremity, is reviewed. The effect of treatment on this index of circulation was determined. Four forms of treatment were used: administration of histidine monohydrochloride and ascorbic acid, lumbar sympathetic block with procaine hydrochloride, administration of test doses of 500 mg. of tetraethylammonium chloride and lumbar sympathectomy. The variations in the circulatory indexes were interpreted as signifying the response of the capillary bed to peripheral vasodilators. The capillaries are considered to have an independent circulation, based largely on the demand for and deficit of oxygen. The responses to treatment in the patients in the four groups were as follows: In group 1, the capillary tone was restored; in group 2, minor vasospastic elements were relieved but capillary dilation persisted; in group 3, major vasospastic elements were relieved but capillary dilation persisted or increased, and in group 4, deterioration of peripheral circulation was almost complete and amputation was required. Radioactive phosphorus is useful as a diagnostic and prognostic tool in the evaluation of peripheral vascular states, such as arteriosclerosis obliterans.

On the Significance of the Normal Electrocardiogram in Old Age. Theodore T. Fox.

Ann. Int. Med. **31**:120 (July) 1949.

One hundred inmates of an institution for the aged showing normal electrocardiograms were followed for a period of seven years. By the end of the second year, 22 cases were found to have abnormal electrocardiographic tracings. By the end of the fourth year, 36 cases possessed abnormalities in the electrocardiograms. By the end of seven years, 47 inmates had abnormal changes in the electrocardiogram. In evaluating the significance of the abnormal tracings the related factors considered were age, the level of blood pressure and the presence of heart enlargement. It became apparent that while the occurrence of the abnormal electrocardiogram in senescence has a prognostic significance, it is the presence of heart enlargement that is a more determining factor of the life span of the aged individual.

Physical Medicine in the Treatment of Varicose Veins and Indolent Varicose Ulcers. Myer Fisher.

Brit. J. Phys. Med. **12**:58 (May-June) 1949.

On looking back over many years at the time wasted in the usual treatment of varicose ulcers by hot dressings and various plasters, one cannot help deploring the fact that many of these patients still attend at doctors' surgeries and hospital outpatient departments, without receiving treatment by ultraviolet light and the application of adhesive elastic plasters. In a series of cases, the following technic was used for treatment of ulcer: To all ulcers either hot saline or magnesium sulphate packs were applied for one week, and infrared irradiation was applied at 18 inches distance for 15 minutes until the local swelling had subsided. The ulcer and the skin around it were irradiated with ultraviolet light by means of either the mercury vapor Alpine lamp or the Kromayer lamp, until a good erythema was produced. The rest of the leg was protected. A Cellanband, Flexoplast or Elastoplast bandage was then applied from above the toes, over the heel and up to the knee, for 1, 2 or 3 weeks, and the patient was told not to remove the plaster, no matter

what was the odor, but just to apply some lint or cotton-wool over the area if the discharge soaked through. If the leg was too sensitive or became too irritable then Ichthopaste bandage was used instead. The use of ultraviolet irradiation undoubtedly results in a quicker response than does the use of the Elastoplast alone in clearing up the foul spectic state so often met with in these conditions. This is in conformity with the physiologic responses to the use of ultraviolet light. Pain, too, is relieved because of the reduced sensitivity of local nerve terminals. The skin becomes much more healthy, in consequence of increased leucocytosis and phagocytosism, and the odor disappears as a result of the bactericidal and hemobactericidal reactions.

Muscular Atrophy in Diseases of the Lower Motor Neuron: Contribution to the Anatomy of the Motor Units. Gunnar Wohlfart.

Arch Neurol. & Psychiat. **61**:599 (June) 1949.

The microscopic picture of muscular atrophy secondary to pathologic changes in lower motor neurons is described in detail. The material comprised specimens of muscle from 46 cases of amyotrophic lateral sclerosis, in 2 of which autopsy was performed; 8 cases of progressive neural muscular atrophy; 24 cases of polyneuritis; 2 cases of periarteritis nodosa, in 1 of which autopsy was done; 4 cases of porphyria, and 6 cases of syringomyelia, 1 with autopsy. Furthermore, a muscle was examined from a rabbit in which ischemic changes in the spinal cord had been artificially produced. The muscle material from cases of acute poliomyelitis has been reserved for a later report. Certain results, however, are incidentally mentioned. Biopsy of muscle is of definite value for the establishment of the diagnosis of the aforementioned diseases. In muscular atrophy due to successive destruction of individual lower motor neurons, the muscle picture exhibits certain characteristics. In such a case biopsy often produces conclusive evidence for the diagnosis of "successive, disseminated neurogenic muscular atrophy." This type of disease is characterized by the atrophy of fibers in groups, a number of which are visible in a transverse section of the muscle. The fibers of one and the same group exhibit the same degree of atrophy, but the groups show different stages of atrophy. The arrangement and appearance of the muscle fibers in these groups, as well as their relation to their environment, is described in detail.

A Walking Aid for Spastic Children. Philip Wrightson.

Brit. J. Phys. Med. **12**:68 (May-June) 1949.

A device is described which reduces the effective weight of a patient during walking exercises. It is of most value in the early walking practice of spastic children. It is stressed that it is an aid to, and not a substitute for, the proper training in movement which is the fundamental therapy for these children. The device also can be used in other conditions in which there is weakness or incoordination of the legs, and for mobilizing otherwise bedridden patients.

Acute Anterior Poliomyelitis: Case Report with Comments on Therapy. Wm. H. Izlar, and John E. Wright.

J. Florida M. A. **36**:98 (August) 1949.

Aware of the dangers of conclusions based on the analysis of one case, we were prompted to report this case and its apparent response to the therapy given because of its remarkable correlation with some ideas presented in the experimental literature. A case of ascending poliomyelitis of a bulbar type is presented in which the patient recovered without residual paralyses on a continuous regime of coramine and vitamin C. No definite conclusions can be made on the analysis of one case. New therapy for poliomyelitis and the therapy used in this case are discussed with the conclusion that the treatment caused an increase in metabolism which may have served to protect neurons from the poliomyelitis virus.

The Topographic Pathology of the Cerebral Lesions of Acute Poliomyelitis in Man: X—The Medulla Oblongata. James H. Peers, and R. D. Lillie.

Am. J. Path. **25**:725 (July) 1949.

In a study of the anatomic distribution of the lesions of acute poliomyelitis in 42 specimens of the medulla oblongata, it was found that lesions of maximum severity are regularly encountered in the reticular substance, nucleus ambiguus, and supraspinal and spinal accessory nuclei. Other somatic and branchial motor nuclei unaccountably present much less severe and constant lesions. Nuclei of the sensory components frequently contain a few small lesions. Such lesions are somewhat more numerous and severe in the somatic than in the visceral sensory nuclei. The occurrence of single necrotic nerve cells with typical reactions in each of these nuclei in a few specimens indicates that the cells of the sensory nuclei are not completely refractory to the virus of poliomyelitis. While a few individual specimens presented moderate quantitative differences from the average pattern of lesions, the series as a whole gives a general impression of uniformity. Within the series no grouping is discernible that suggests an essential difference of pathogenicity of supposedly various strains of virus. Also, there are no consistent differences in disease pattern corresponding to the stated duration of illness, or to whether it began with bulbar or spinal symptoms. We are obliged to conclude that death in poliomyelitis occurs when a certain and fairly constant amount of damage is produced in the medulla, and that the final pathologic end-result, in the medulla at least, is relatively uniform, and apparently independent of the route of spread of the virus, or of the speed with which the vital centers are overwhelmed and disorganized.

The Ataxias: A Review. David Fiske.

Arch. Int. Med. **83**:593 (June) 1949.

Classic description of the ataxias in textbooks are short and convincing, comprising two or three paragraphs, and frequently giving the impression that all of importance is known and well established. Certain "classic, pathognomonic" characteristics are described, with the knowledge of which one can make the diagnosis infallibly. Examination of the literature discloses considerable confusion concerning ataxia. The confusion is further emphasized by the absence of an adequate review of the subject. It is felt, therefore, that the present attempt to summarize some of the pertinent data in the literature and associated efforts to simplify the classification of ataxia may be of help to the nonspecialist. Though one is not generally accustomed to thinking in such terms, there are, in reality, many types of ataxia. As one reconsiders the various descriptions, observations and opinions outlined it may seem that a good deal of hair-splitting exists. One must get down to fundamentals and think of dynamics. Even hereditary diseases, when viewed in the newer light of Beadle's work, may appear in the nature of incomplete metabolic processes, amenable to correction. To assume that heredity alone is enough to account for the onset of a disease in adult life is unreasonable. To be sure, these various ataxias may be different entities, but one is not in the position to say that they are. One must think in terms of fundamental physiology and dynamics and the various possible etiologic factors. Only in this way can one make progress toward the ultimate goal, which should be to understand these disease processes thoroughly, to pigeonhole them correctly and, above all, to treat them more satisfactorily.

Psychogenic Rheumatism. William Tegner; Desmond O'Neill, and Anna Kaldegg.

Brit. M. J. **4620**:201 (July 23) 1949.

The principal diagnostic features of psychogenic rheumatism appear to be in expression of complaint; area of discomfort; failure to conform to an established organic syndrome; setting of the illness in relation to the patient's life situation, and lack of response to physical treatments. The treatment and disposal of patients regarded as suffering from psychogenic rheumatism has always provided a real problem to the clinician. It is part of the syndrome that they do not respond to treatment which is limited to physical measures. It seems clear that to these patients their suffering is something very personal and valuable; it makes them important, interesting, and worthy of sympathy, and is a protection against an unkind world. To treat them with passive physical therapy is to acquiesce in their own diagnosis of disease and to allow it to take a deeper root. Such treatment usually gives temporary relief but does not cure; after a time it may come to be indispensable to the patient. Physical therapy which is painful may remove the symptom; another symptom will then take its place. Injections of a local analgesic may be tried; they generally have a dramatic effect. Even as little as a few drops of 1 per cent procaine may lead to fainting and hysterical manifestations. One of us has attempted to treat the patients in groups by general ultraviolet irradiation followed by exercises; this method has had some success. Group psychotherapy of selected patients has been started and has already given encouraging results. It is probable that an approach along these lines will prove to be the most profitable measure. An investigation by a physician, a psychiatrist, and a psychologist of a group of patients suffering from a rheumatic disorder without signs of organic disease is described; a comparison with a control group is made. In the former group the disorder was found to have certain special characters; in most cases the onset and course of the condition could be correlated with emotional disturbance. The condition seems to merit recognition as a clinical entity; it may be described by the term "psychogenic rheumatism."

Neurocirculatory Asthenia. Walter M. Bartlett.

Ann. Int. Med. **30**:966 (May) 1949.

In our experience neurocirculatory asthenia accounts for 6.8 per cent of the admissions to the cardiovascular section of a large general hospital in the United States; 4.6 per cent of the admissions to a comparable unit in the European Theater of Operations and 6.3 per cent of the admissions to the cardiovascular section of a Regional Hospital in the United States. It was found to be an excellent policy in our series as well as those treated by Hill and Dewar to forbid further medical examinations or the taking of pulse rates, blood pressure or temperature once the original complete examination was finished. This gave no further suggestion to the patient that anything but recovery was expected. Graduated physical exercise and reassurance by all concerned was the keynote of treatment. Exercises were started with easy drill and physical exercise under careful supervision. Progress was required but it could be slow for some groups and more rapid for others. Group psychotherapy was found to be most helpful in the hands of physicians possessed of the necessary orientation and ability. Privilege rewards for accomplishment were considered extremely helpful in keeping up the interest of participants. Cases not making satisfactory progress were counseled by the psychiatrist and those responding well were discharged from the hospital without further examination. The pathogenesis of neurocirculatory asthenia has been studied by a great many careful observers and specialists in various fields of medicine. That the symptoms can be produced physiologically in susceptible individuals has been shown conclusively. It also has been shown that the symptoms are usually relieved by physiologic rest and measures directed toward improved physical adaptation. Methods for the detection and differential diagnosis have been discussed and the problem from a military standpoint is reported. Experience with a large number of patients suffering with this manifesta-

tion of a psychosomatic disease undoubtedly has served to familiarize many physicians with a practical method of dealing with these daily problems.

Joint Manipulation in Rehabilitation. R. J. Talbot.
Brit. J. Phys. Med. 12:62 (May-June) 1949.

A frequently employed physical method in rehabilitation from disease or injury is movement by joint manipulation. Its object is the restoration of the full anatomical range of movement to any joint which is either directly or indirectly restricted. Joint manipulation entails the use of scientifically applied force to secure a range of movement greater than that obtainable by the patient's voluntary action. Such manipulation is to be distinguished from manipulation for reduction of dislocation or for setting a fractured bone, but, similarly, it should be performed by qualified medical personnel. Manipulation is an aid to other physical measures which must both precede and follow manipulation. The early and adequate application of these measures reduces the necessity for joint manipulation, particularly in the acute phase of chronic arthritis and trauma. Neglect renders manipulation the more necessary.

Manipulation may be divided into two types, major and minor. Major manipulation is employed in chronic traumatic and disease conditions when great restriction of movement exists, and when response to minor manipulation is negative or unreasonably slow. Repeated minor manipulations follow this operation. Minor manipulations are adopted when a gradual stretching of shortened structures is required, as in cases of disuse, contracture, cicatrization, prolonged immobilization or in soft-tissue lesions. All joint manipulations conform to certain principles, which are as follows: to secure greater movement of the joint with the patient relaxes, by employing gentle passive force beyond the range obtainable actively by the patient; to protect manually the component bones and ligaments of the joint; to apply a degree of traction of the distal upon the proximal bone or bones of the joint; to limit movement to the anatomical range of that joint; to overcome the obstruction encountered, by means of a deft, well-practiced increase of force; to cease applying force when "give" has occurred and the full range in the desired direction has been obtained, and to advance movement only when complete relaxation is present.

Fibro-Fatty Tissue and Its Relation to Certain "Rheumatic" Syndromes. W. S. C. Copeman.
Brit. M. J. 4620:191 (July 23) 1949.

It is thought that an etiological classification, although desirable in the case of a "disease entity," must remain impracticable in the case of a syndrome. The classical conception of fibrositis is briefly reviewed, and a classification based upon the structure of the nodules found at the source of the pain is tentatively proposed. Evidence is produced that the fat tissues of the body are subject to pathological variations which cause pain. This pain is generally labelled as "rheumatic" or "fibrositic." When this occurs in the neighborhood of joints the condition often is wrongly termed arthritic. It has been shown that several recognizable "rheumatic" syndromes can be the result of an abnormal retention of fluid by fat lobules in certain situations. When this occurs they endeavor to swell, but, being confined by indistensible fibrous tissue, they are unable to do so, and tension pain results. This edema shows no sign of being inflammatory in nature. In some such cases a flaw occurs in the fibrous covering, resulting in herniation of the enclosed fat lobule into an adjoining layer. Such herniations may be of three types, which are described. The origin of this selective swelling probably is endocrine. The direct effect of cold may unmask it. The syndromes described as being due to this abnormality of fat are: (a) Fibrositis, which occurs in any of the several normally occurring fat-pads which are described, and (b) Panniculitis, which occurs in abnormally deposited fat, mostly in predictable sites. Panniculitis may occur with or without general obesity. In either case the chief sites of pain tend to remain similar. Adiposis dolorosa (Dercum's disease) would appear to be only a quantitative variation of this combination. Treatment must be directed concurrently along several lines if success is to be achieved. Those discussed include diet, endocrines, diuresis and dehydration, local injections, physical therapy, and surgery. The indications for surgery are limited but tend to afford dramatic relief. These are the removal of irreducible fat hernias, and to a smaller extent removal of localized areas of painful tissue in severe cases of Panniculitis.

Suture of Peripheral Nerves: Factors Affecting Prognosis. John W. Kirklin; Francis Murphey, and Joseph Berkson.
Surg., Gynec. & Obst. 88:719 (June) 1949.

All who have cared for patients in whose case a peripheral nerve has required suture know that complete recovery of function of the involved nerve does not always occur. Yet it also is known that under the proper circumstances an extremely gratifying recovery can ensue. These data lend factual confirmation to the results of many previous studies, and also the impressions of many who have managed peripheral nerve injuries. Complete recovery of function, to a degree comparable to the normal state, is indeed rare after nerve suture. Eminently satisfactory recoveries, however, can be obtained in many instances. The patient's interests are best served by accurate end-to-end anastomosis of the nerve wthin three months after injury and preferably in the first month after injury. High-lying injuries, such as those of the brachial plexus, should be an especial stimulus to early repair. However, repair is of value, though limited, when done as long as 15 months after injury. Beyond this point, motor recovery will rarely result but some return of crude sensory function may occur.

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PHYSICAL MEDICINE ***

The following services are approved by the Council and the American Board of Physical Medicine and Rehabilitation

Hospitals, 39; Assistant Residencies and Residencies, 65

Name of Hospital	Location	Chief of Service	Inpatients Treated	Number of Treatments	Asst. Res. & Residencies Offered §	Beginning of Service (1949)	Beginning Stipend (Month)
United States Army							
†Letterman General Hospital★	San Francisco	A. E. White	14,163	207,661	2	.....	n
†Fitzsimons General Hospital★	Denver	H. B. Luscombe	20,370	240,636	2	.....	n
Walter Reed General Hospital★	Washington, D. C.	E. M. Smith	6,849	174,825	1	1, 7	n
Veterans Administration							
†Veterans Admin. Hospital [1]	Ft. Logan, Colo.	C. C. Hoffman	2,875	48,162	1	.....	n
Veterans Admin. Hospital	Chamblee, Ga.	G. D. Williams	1,905	37,824	1	7/1	n
†Veterans Admin. Hospital	Hines, Ill.	L. B. Newman	12,600	486,539	7	.....	n
Veterans Admin. Hospital [1]	New Orleans, La.	S. Winokur	928	35,356	1	7/1	n
Veterans Admin. Hospital [1]	Framingham, Mass.		3,008	94,543	2	.....	n
†Veterans Admin. Hospital [1]	Jefferson Bks., Mo.		1,141	75,519	1	.....	n
†Veterans Admin. Hospital	New York City	H. Kessler	3,612	290,091	3	7	n
†Veterans Admin. Hospital [1]	Cleveland, Ohio	H. T. Zankel	14,030	142,719	..	.....	n
†Veterans Admin. Hospital	Portland, Ore.	E. W. Fowlks	4,078	95,079	1	1/1, 7/1	n
†Veterans Admin. Hospital	Aspinwall, Pa.	S. Machover	1,919	61,934	..	7/1	n
Nonfederal							
Los Angeles County Hospital★[1]	Los Angeles		.....	114,657	1	Varies	$165.00
†White Memorial Hospital★	Los Angeles	F. B. Moor	231	.....	1	7/1	140.00
Stanford University Hospitals★[1]	San Francisco	W. H. Northway	.....	7,445	2	7/1	50.00
University of Colorado Medical Center							
†Colorado General Hospital★[1]	Denver	H. L. Dinken	2,320	49,307	1	7/1	75.00
†Emory University Hospital★	Emory Univ., Ga.	R. Bennett	9,564	22,721	1	7/1	.....
†Georgia Warm Springs Foundation	Warm Springs, Ga.		.....	.....	1	.....	.....
Michael Reese Hospital★[1]	Chicago	C. O. Molander	2,678	25,219	2	.....	25.00
Passavant Memorial Hospital★	Chicago		12,403	34,185	..	.....	.....
University of Kansas Medical Center★	Kansas City, Kan.	D. L. Rose	7,452	27,094	3	.....	.....
†Massachusettts General Hospital★	Boston	A. L. Watkins	.....	.....	2	.....	.....
†University of Minnesota Hospitals★[1]	Minneapolis	M. Knapp	8,018	12,580	3	.....	.....
Mayo Foundation	Rochester, Minn.	F. H. Krusen	.....	.....	9	.....	92.50
†Bellevue Hosp., Div. III—N. Y. Univ.★[1]	New York City	H. Rusk	35,406	63,198	4	.....	60.00
†Goldwater Memorial Hospital★[1]	New York City	H. Behrend	950	69,483	1	7/1	70.00
†Hospital for Joint Diseases★[1]	New York City	J. Weiss	62,557	87,314	2	1/1	40.00
†Hospital for Special Surgery	New York City		.....	.....	..	.....	.....
†Montefiore Hosp., for Chronic Diseases★[1]	New York City	K. Harpuder	1,597	25,500	1	.....	.....
†Mount Sinai Hospital★[1]	New York City	W. Bierman	2,610	52,705	1	.....	50.00
†Presbyterian Hospital ★[1]	New York City	W. B. Snow	71,514	198,791	1	.....	41.66
St. Luke's Hospital★	New York City	R. Muller	24,412	95,718	1	7	50.00
†Rehabilitation Hospital [1]	W. Haverstraw, N. Y.	M. Hoberman	415	237,356	..	.....	.....
†Cleveland Clinic Hospital [1]	Cleveland	W. J. Zeiter	16,060	37,691	1	7/1	100.00
†Hospital of the Univ. of Pennsylvania★[1]	Philadelphia	G. M. Piersol	1,106	14,557	1	Varies	.....
†Medical College of Virginia, Hosp. Div.★[1]	Richmond, Va.	W. J. Lee	3,047	31,433	1	7/1	46.50
†State of Wisconsin General Hospital★[1]	Madison, Wis.	H. D. Bouman	1,988	18,291	2	.....	.....

The star (★) indicates hospitals that are also approved for the training of interns. All hospitals on the approved intern list are likewise accredited for general residencies which represent general house staff assignments following the internship.

The dagger (†) represents temporary approval, pending formal inspection, in accordance with the plan for the temporary approval of residencies in specialties as announced in THE JOURNAL, A. M. A., March 2, 1946, p. 586.

n Indicates that the salary is established by government pay tables.

[1] Represents residencies open to women.

*** Rep. in part J. A. M. A. **140**:205 (May 14) 1949.

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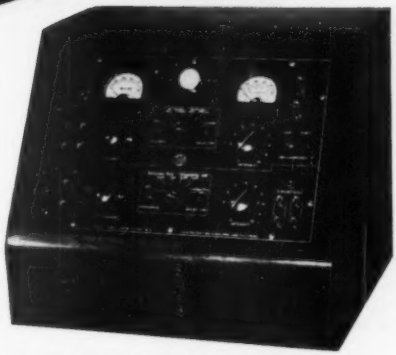

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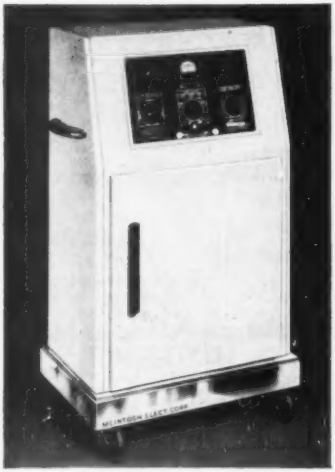

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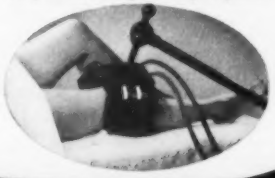

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